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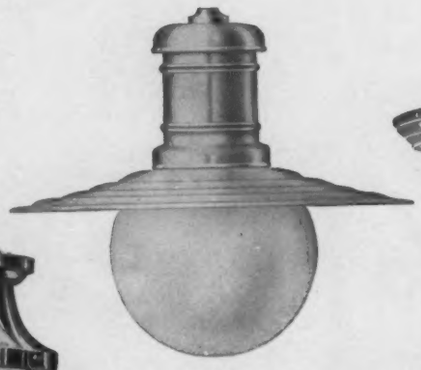

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INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

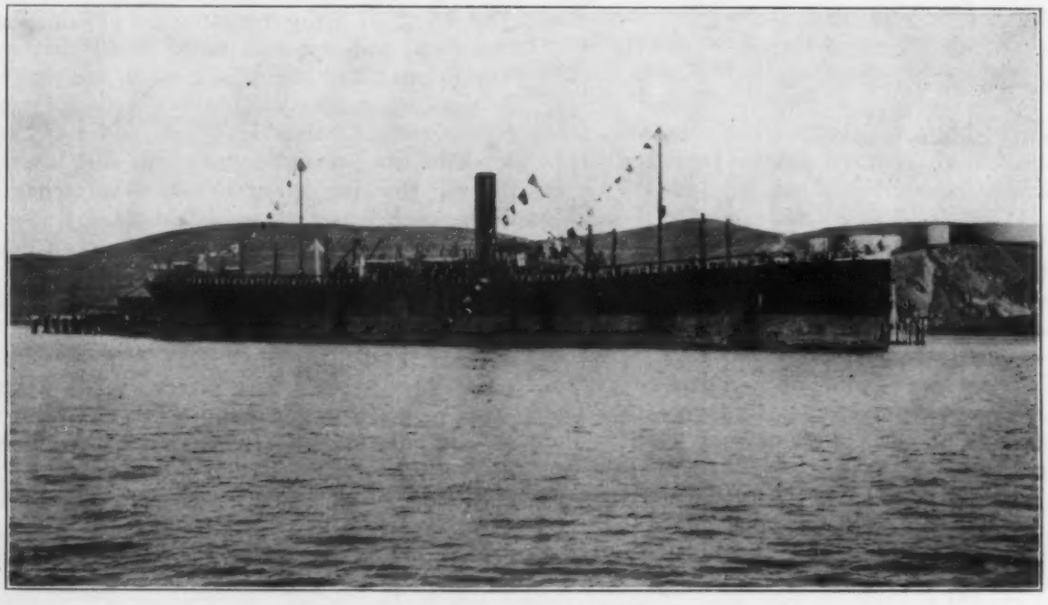
(This article is the first of a comprehensive series which will deal with all phases of the application of fuel oil to industrial purposes. This installment gives a brief introduction to the subject and presents details of approved methods of oil storage—The Editor.)

Oil as a Fuel.

The use of oil as fuel has been a remarkable development of the past few years. After carefully investigating the source of supply, both the older oil fields that have long been producing as well as the newer fields, such as those in Mexico, together with the possibilities of finding oil in Central and South America, the navies of the world have decided to adopt oil as fuel for part of their fleet, at least. With the erection of large oil storage tanks throughout the important seaports of the world the steamship companies also do not now hesitate to equip their steamers for burning fuel oil.

The opening of the Panama Canal will change the old established routes of many steamship lines and fuel oil from the California, Mexican and Central American fields can be obtained at an attractive figure at the Canal. Thus steamers operating from New York or European ports, through the Canal to Pacific or China ports, will be able to take advantage of the cheap fuel. The large oil storage tanks that have been erected through the country, insure to the industrial manufacturer also, a steady and regular supply of fuel oil.

These vast storage tanks, the many oil tank cars operated by the railroads, the numerous tank steamers carrying the oil to all parts of the world, and the new oil fields have eliminated any question as to an adequate supply.



A Fuel Oil Tank Steamer.

The use of fuel oil is now well established, and new uses are being discovered daily. The question of cheap transportation of this valuable product has been solved by the large tank steamers, some of which carry over 120,000 bbl. of oil. When the authorities decide the rate question of transporting oil by tank cars and pipe lines, a still lower price will probably prevail.

Some crude oils are suitable for fuel in their natural state, for others lighter gases must be distilled. Most of the fuel oil sold has been refined, being the

residue from the crude petroleum after the more valuable ingredients have been taken out and much of the sulphur removed. The calorific value of the fuel oils from the different countries varies but little from 18,500 B.t.u.

In figuring the comparative value of fuel oil and coal the steam engineer usually compares the amount of water evaporated by unit weights of oil and coal; the electrical engineer figures the kilowatt hours produced with each pound of fuel, while manufacturers are interested in the equivalent value of a barrel of oil, compared with a ton of coal, a cord of wood, or a thousand cubic feet of gas. On account of the widely different heating values of various fuels, it is difficult to prepare a table showing exactly the equivalent value of one barrel of oil. The following table affords a rough comparison between coal fuel under similar conditions of boiler loading.

TABLE I.

Fuel—	Coal.	Oil.
Gravity of oil, Baume		16.2°
Per cent of moisture in fuel	3.9	1.5
Per cent of ash	17.87	
Calorific value, by Parr Calorimeter, per pound of dry fuel, B.t.u.	11,811.	18,099.
Boiler Horsepower—		
Horsepower developed, A. S. M. E. rating	832.3	241.
Builder's rated horsepower	700.	200.
Per cent of builder's rating developed	118.9	120.
Economic Results—		
Water apparently evaporated under actual conditions per pound of fuel	7.118	13.12
Equivalent evaporation, F. & A., 212° F. per pound of fuel	9.0767	15.11
Same per pound of dry fuel	9.4451	15.34
Same per pound of combustible	11.83	15.34
Efficiency—		
Efficiency of boiler	82.76	81.8
Per cent of steam generated used by stoker	5.8	
By burner		3.58
Analysis of Dry Gases by Volume—		
Carbon dioxide	7.82	14.6
Oxygen	7.50	1.2
Carbon monoxide	.13	.00
Nitrogen	84.55	84.2
Per cent of excess air above amount theoretically required	50.	5.6

It has been common practice to estimate four barrels of oil equal to one ton of coal, but that this is not always the case is proved by the following test. Under a boiler one pound of coal evaporated 7 lb. of water from and at 212 degrees F., and one pound of oil evaporated 15 lb. of water from and at 212 degrees F. The rates of evaporation per pound of fuel were in the ratio of 7 to 15; and as the coal weighed 2000 lb. per ton and the oil 330 lb. per barrel, one ton of coal was equivalent to $\frac{2000 \times 7}{330 \times 15} = 2.828$ barrels of oil. On the other hand, a good grade of coal may have 14,500 B.t.u. per pound, while oil averages 18,500 B.t.u per pound. The theoretical equivalent of one ton of coal in this case is $\frac{2000 \times 14500}{330 \times 18500} = 4.75$ barrels of oil.

These cases may seem extreme, but they indicate the danger of using "rules of thumb" in making preliminary calculations of fuel consumption. The writer has seen many cases in which a contractor has failed to meet his specifications, simply because he took it for granted that four barrels of oil were the equivalent of one ton of coal.

It is equally difficult to compare the heating value of a cord of wood with that of a barrel of oil. The heating value of the wood in question must be known, as well as the percentage of water that it contains, before making a comparison with oil fuel.

The type of furnace in which the oil is to be used is an important consideration in making any comparison with other fuels. Assume, for example, a furnace which has an efficiency of 76 per cent when burning coal. If, upon converting this furnace to an oil-burner, it has an efficiency of 83 per cent, the amount of oil required will be less than the amount indicated by a comparison of the heating values of coal and oil. As a rule such an improvement in efficiency may be expected from the conversion of a coal burning to an oil burning furnace, provided the installation is made by a competent oil expert. This is partially due to the higher furnace efficiency inherently attainable with fuel oil. But a more important cause lies in the fact that the average plant using coal as fuel is attended by an unskilled fireman, who can only get the best results from coal by hard work, close attention, and intimate knowledge of the coal. Often he does not understand the most efficient method of firing the coal or regulating the draft, and as a result a great deal of fuel is wasted. This point is clearly brought out when a coal or boiler expert is brought in to conduct a test; much higher efficiencies are invariably attained.

Conditions are very different in a plant using oil. The work of firing requires no physical exertion; a clear eye and common sense is all that is required. The fireman has plenty of time to see that the burner is working properly and that a uniform amount of feed water is being supplied; and by watching the stack he can prevent some of the fuel losses that take place if smoking is permitted. Also, when using fuel oil a much better class of labor can be secured; this has been clearly proven on board ocean going steamers.

The writer can remember the time when it was almost impossible to secure firemen on a certain steamer, and many that were secured were unfit for work during their first watch, three watches being often required to get them in good working condition. It was laborious, hot work, as the steamer was running to the tropics. The firemen usually made but one voyage and a new crew had to be obtained each trip. This vessel is now using fuel oil, and I have been informed by the engineers, that they seldom make a change in the fire room crew.

Purchasing Fuel Oil.

With the supply of oil fuel assured, the question of greatest interest to the engineer is how to buy it. The price of the oil must of course be low enough to warrant making the fuel oil installation. And the time for which this price is guaranteed in the fuel oil contract should be long enough to enable the consumer to save on his fuel bill at least the cost of making the oil installation.

The analysis of crude and fuel oils varies with the wells or countries from which the oil is obtained. The characteristics required by the purchaser should be embodied in a contract; a good commercial fuel oil should be of the following specifications:

Specific Gravity at 60° Beaume.....	Not less than 14°
British thermal units.....	Not less than 18,500
Water	Not over ½%
Sulphur	Not over 2%
Dirt, sand, etc.....	None
Flash point.....	Not lower than 140° F

Before making the fuel oil installation, a fuel oil expert should be engaged. He should be familiar with the rules and regulations regarding the location of oil storage tanks enforced in the particular locality by the inspectors, fire marshal and insurance officials. These regulations vary greatly in different states and countries. The accompanying illustrations taken from the official San Francisco Fire Department ordinances, will serve to give the reader an idea of the regulations for the installation of fuel oil storage.

Fig. 1 shows boiler in basement, the sidewalk being excavated and used as part of basement and the owner desiring to utilize all the space under the sidewalk for basement purposes. The top of the storage tank should be 4 ft. below the basement floor; a brick or concrete wall not less than 12 inches in thickness should be constructed around the storage tank, extending from the bottom of the tank up to the basement floor. The space between the top of the tank and the basement floor should be filled with earth and the earth covered with the concrete flooring of basement. Flooring at the bottom of the tank is optional.

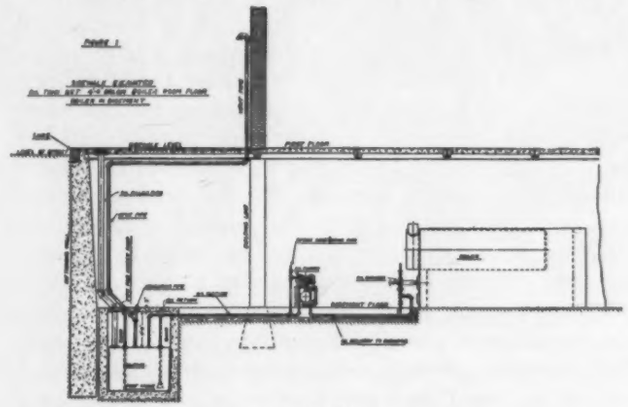


Fig. 1.

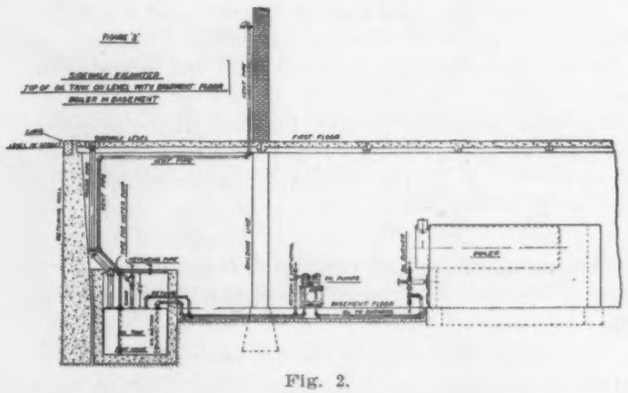


Fig. 2.

Fig. 2 shows boiler in basement, the sidewalk being excavated and used as part of basement and the owner finding he cannot go over 4 ft. below the basement floor. The top of the storage tank should be at least 6 in. below the basement floor, a brick or concrete wall not less than 12 inches in thickness should be constructed around the storage tank, extending from the bottom of the tank up to 4 ft. above the storage tank. The space between the top of the walls should be filled with earth, the earth covered with at least 3 in. of concrete. The flooring at bottom of tank is optional. All oil pipes exposed in building should be fire-proofed, or under the concrete flooring from the tank to the pump.

Fig. 3 shows boiler on the first floor, no basement, sidewalk not excavated. The top of the storage tank should be at least 4 ft. below the sidewalk; a brick or concrete wall not less than 12 in. in thickness should be constructed around the storage tank, extending from bottom of tank up to top of tank. The space between the top of the tank and the sidewalk should be filled earth covered with the sidewalk. Flooring at bottom of tank optional.

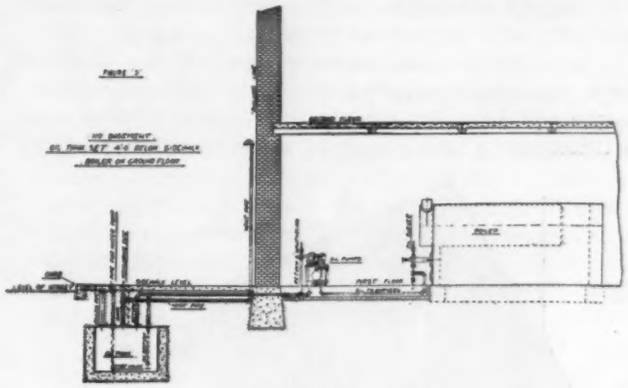


Fig. 3.

Fig. 4 shows boiler in basement, sidewalk not excavated. Top of the storage tank should be at least 6 in. in thickness. A brick or concrete wall not less than 12 in. in thickness should be constructed around the storage tank, extending from bottom of tank up to top of tank. The space between the top of the tank and the sidewalk should be filled with earth, the earth covered with the sidewalk. Flooring at bottom of tank optional.

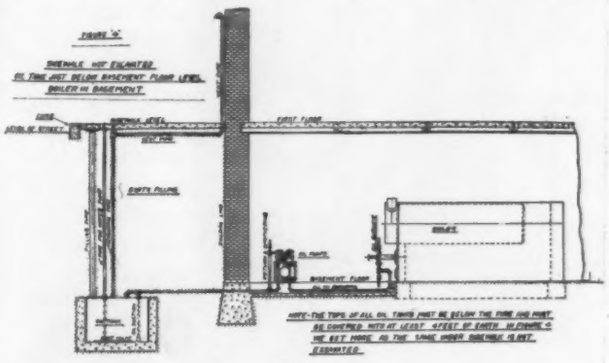


Fig. 4.

All tanks should be of steel construction, thickness of plates as follows: Up to 5000 gallons, 3/16 in. shell; 5000 to 10,000 gallons, 3/16 in. shell, with 5/16 in. heads; 10,000 to 20,000 gallons, 1/4 in. shell, with 3/8 in. heads. Over 20,000 gallons tanks must be of standard specifications for oil tanks.

(To be continued.)

THE TELEPHONE PLANT WITH RELATION TO FIRES.

BY W. D. SCOTT AND G. P. NOCK.

(This interesting description of how the telephone companies prepare against fire is to be presented before the joint meeting of the Portland A. I. E. E. and N. E. L. A. Sections on November 10, 1914. The authors are connected with the Pacific Tel. & Tel. Co. at Portland.—The Editor.)

In the ordinary life of a community there is probably no one thing that will bring out a crowd, at any time of day or night, as will a fire, and I think it is safe to assume that everybody has a dread of fire, not only because of the financial losses that it causes, but from the dangers involved and the tremendous uncertaintainties which are always present.

In presenting this paper to you it is our idea that there are certain relations between the telephone industry and fires that are not to be found in other lines of business. The widespread territory covered by the

Pacific Tel. & Tel. Company's New Building at Portland.

telephone plant and the vast number of complicated circuits in the telephone companies' central offices offer a large field for damage by fire, especially from sources over which we have no control.

A very small fire in a switchboard and one which, in other places would probably be of no consequence whatever, will often do a large amount of damage, not only to the plant itself, but to the entire community, as the latter may find itself without telephone service for hours or even days, and in these modern times telephone service has ceased to be a luxury, and is now a business necessity.

The telephone company has its own particular fire hazard. There is not only the fire hazard of the plant itself, but because of its distributed nature, reaching as it does over an entire community, serious damage may be caused through a fire hazard for which the telephone company is in no way responsible and can in no way abate.

Reaching out from its central offices is its distributing system of wires and cables. In the more congested districts of the larger communities and wherever it is commercially possible to do so, the wires of the telephone companies have been placed under ground. In the residence districts and in the outlying portions which are thinly settled we are, as yet, unable to place our wires under ground except at an expense which would make the cost of telephone service prohibitive. The type of aerial construction which is now placed on poles is vastly superior to that which was in vogue several years ago. No longer do you see the high pole, 60 or 70 or 100 ft. high, filled from its top almost to its bottom with crossarms and carrying possibly 100 or more separate wires. Today the high pole lead has been replaced by a short one and all the separate wires have been grouped together and placed in cable. In this way many risks of fire and damage by foreign electrical currents have been obviated.

Even now, in a city there is is always a possibility that the wires of the signal company, such as the telephone company, may become crossed with power wires. Such an accident may result in a current of electrical energy many times larger than telephone current being carried by the telephone wire. Without some adequate means of protection this electrical current may be taken in the buildings of the customers or into the central offices of the telephone company.

Protective System.

At each subscriber station where there is any possibility of a connection being established between the wires of the telephone company and the wires of the power company, a protective device is installed to operate automatically in case the wires of the telephone company should ever carry any excessive amount of current. At all of the junctions between aerial and underground cables similar protective devices are placed in order that the line may be opened by means of this protective equipment under conditions of excessive strain due to surplus quantities of electrical energy.

In the earlier years of the telephone industry considerable damage was sometimes done through lightning. Damage from this source usually occurred to plant and property of the telephone company through the destruction of instruments, cables or central office equipment. Included in the protection installed in the telephone company's premises, in their cable boxes and at the subscribers stations is a protective device which conveys to earth lightning discharges and in this way prevents damage. Inside of the central office itself, where is placed the brain of the telephone industry,

the entering wires or cables are equipped with protectors, which will carry to ground any electrical current that is of sufficient magnitude to damage the central office equipment or cause a fire.

The design and operation of this protective system shows to what extent the fire risk incident to electrical hazard in an extensive wire plant has been considered.

For convenience we have divided it into three groups:

First: The subscribers station.
Second: The cable plant.
Third: The central office.

At the subscribers station two fuses are provided. These fuses consist of a fibre or porcelain tube approximately 5 inches long, arranged at the ends with suitable terminals for holding the wires and containing in the center of the tube a strip of metallic alloy which will melt when the current carried by the metal strip exceeds a predetermined amount.

The wires to the subscribers' premises are attached to these fuses, either on the outside of the building or immediately inside of the building. When placed inside they are mounted on porcelain supports and all wiring is carried on porcelain insulators and well separated.

Associated with these fuses is a metal-covered porcelain block on which are mounted four small pieces of carbon. These pieces of carbon are separated by a piece of notched mica .0055 inches in thickness. Two of the carbon blocks are connected to earth and two are connected to the line wires. Under normal conditions the thin piece of mica separates the two carbons connected to the line from the two pieces of carbon connected to ground.

The air gap between the two pieces of carbon is such that a potential of 300 volts will arc across between the carbons to ground. In one of the carbons is a plug of readily fusible metal which will melt and connect the two carbon blocks solidly together. Should an excess current ground the line through the carbon blocks there is a sudden rush of current in the line and the metallic strip in the fuse melts and opens the line.

At the junction of the aerial wire and the **cable plant,** fuses, which are duplicates of the ones at the subscriber's station, are placed. In addition to this where the open wire is subject to lightning disturbances copper blocks separated by a thin piece of mica are installed. These copper blocks are arranged similarly to the ones at the subscriber's station, but operates a potential of 1000 volts instead of 300.

In the central office, as near as possible to the point of entrance, is placed a set of carbon blocks similar to the ones at the subscribers station and in addition a piece of apparatus known as a "heat coil."

This equipment consists of a small coil of fine wire wound over a copper shell. Inside this copper shell is a tinned copper pin held in place by solder which has a low temperature coefficient. A current of .5 of an ampere passing through the coil of wire will cause the solder to melt in less than 210 seconds. The melting of the solder will release the pin and by means of the device which holds the heat coil in place, the pin is forced in contact with a grounded plate.

The central office protection will complete a connection to earth in two ways. One, through a voltage in excess of 300 volts jumping the air gaps between the carbon blocks to ground and the other through a very small current melting the solder of the heat coil. The operation of either of these protective devices permits the excess current on the line conductors flowing directly to earth. Any sudden rush of current caused through grounding the line opens the fuses, which are placed between the aerial and underground plants or between the open wires and cabled conductors.

Constructional Precautions.

In order to still further reduce the hazard which might be caused by electrical construction of all kinds efforts are being constantly made to improve conditions and methods. A joint committee from various electrical associations have adopted specifications for "Overhead Crossings of Electrical Light and Power Lines." These specifications apply to overhead electrical light and power line crossings over railroad right of way, tracks, or lines of wires, and to overhead electric light and power wires of over 5000 volts constant potential, crossing or constructed over telephone, telegraph or other similar lines.

They set forth in detail the location and kinds of supports to be used, the clearance between wires, distance from inflammable material, the size and kind of conductors to be used, guys, clearing of spaces about supports so that they may be free from inflammable material, and many other important details. They represent the consensus of opinion of the best available engineering talent in this country as to what is considered safe construction, when it is necessary that the wires of one wire using company cross over the wires of another company or over the tracks of a railway company.

Realizing the importance of this subject, the various public service and railroad commissions have adopted rules covering construction methods which take into consideration fire risk and possible injury to employes or the general public.

In addition to this the various municipalities have their own sets of rules.

In many cities there are joint pole agreements in force between the various pole using companies. These agreements have to do with the joint occupancy of poles by more than one company. This arrangement does away with the number of poles in the streets and has led to each company placing a more substantial type of construction.

Generally the outside plants of wire using companies are being constructed at present in a more substantial manner than in the past. The various interests see that the whole public can be best served by a complete understanding as to what is required of all and are trying to furnish their own service, be it light, power, telephone or telegraph, in such a manner as to reduce the total hazard to a minimum.

Housing Apparatus.

The apparatus inside of a telephone office is complicated. Not only is this true on account of the functions which it has to perform, but further complications are introduced through limited amount of space

which can be economically used for accommodating a comparatively large quantity of equipment.

From the very nature of the equipment it is very subject to damage from water or fire.

The first essential of a central office is proper housing. The buildings must be well built, they must afford proper space for the equipment and they must be so designed as to afford ample light and air for the employes. In addition proper fire protection measures in the way of emergency exits and fire protective apparatus must be provided.

It is now generally the practice for the telephone companies to erect their own buildings in all of the larger cities. These buildings are of two classes: the so called slow burning mill type of construction or the latest type of steel frame, concrete fire-proofed construction with reinforced concrete floors.

Buildings of the slow burning mill construction type are only erected in the outlying or residential sections and are usually built with brick or reinforced concrete walls. The floors consist of timbers 2 inches in width and varying thickness from 14 inches up, spiked solidly together. These floors are supported on heavy timbers which are in turn supported by cast iron or wooden pillars.

Buildings of the steel frame type, have the steel framing fire-proofed with reinforced concrete and reinforced concrete floors. The walls are either of brick, terra cotta or reinforced concrete.

In both types of buildings exposed openings or openings adjacent to other buildings have steel sash and window frames and are glazed with wire glass.

In buildings of the steel frame type all sash doors and trim are of metal. All exposed openings, in addition to the wire glass are protected with fire shutters. These fire shutters are equipped with fusible links and will close automatically if the the link becomes fused. All doors at fire and fuel rooms and entrances to cable pits are held open by means of a weight attached to a fusible link. These doors will close by gravity if the link is fused.

Exterior and interior stand pipe systems are installed, The interior stand pipe system is equipped with a fire hose and nozzle at each floor and where a high pressure system of street mains is provided the interior stand pipe system is connected to this system of high pressure mains.

Where it was thought that the pressure of the water system will not at all times be sufficient to meet all emergencies, a direct connected, motor driven centrifugal pump is placed in series with the standpipe. An automatic controlling and motor starting device is associated with the motor so that the motor will start if the water pressure falls below a predetermined amount. Another safeguard is provided in this system. Should the water fail, the stand pipe is carried to the street where a connection can be made to a fire engine. An automatic check valve prevents the engine from forcing water back into the mains.

All elevators are enclosed in a fire-proof elevator shaft with tight doors. The doors themselves are of steel and where glass is provided it is of the wire type.

The fire escapes are stairs of ample width with substantial landings. The exits to the fire escapes are provided with "panic bolts" on the doors. Lights are provided on all fire escapes and these lights are placed on circuits separated from the other lighting circuits of the building.

Where electric elevators are used the leads to the motors are separated from the other electrical wiring of the building and if it should ever be necessary to cut off all of the current from the rest of the building the elevators will still be supplied.

Every effort has been made to have our buildings constructed in accordance with the best advice we can obtain in order that they may be as safe from fire risks within and without as the light of our present knowledge will permit.

Should such a catastrophe as a fire occur we have adopted every device shown to have merit in order that the lives of our employes may be protected to the utmost.

In giving these brief outlines of our building construction we have indicated what are our present methods. Time alone will tell whether or not these present methods will appear as crude in the future as our past efforts do in the light of our present knowledge.

Methods of Fire Protection.

On account of the value of service all telephone companies have taken particular precautions in connection with protection of their central office apparatus against fire.

The various pieces of apparatus can be readily damaged beyond repair by the use of a chemical fire extinguisher. It is doubtful that any more severe damage can be done in the central office of a telephone company than by throwing water on a fire in a telephone switchboard.

As you know, the general practice in all of the larger communities on this continent is to provide telephone systems of the so called "common battery type." This means that all of the signalling and talking functions are supplied with the necessary electrical energy from a common source located within the central office.

Present practice is to use a storage battery for this purpose. The voltage of this battery is seldom less than 22 volts and as far as I know does not exceed 50 volts. The quantity of current under normal conditions does not exceed approximately .1 of an ampere in any part of any one circuit. These amounts of electrical energy are so small that, provided no greater quantity ever flowed, it is probable no fire hazard would ever result.

Accidents, however, are apt to occur. It is necessary to protect the apparatus against dangerously large flows of current. Individual fuses are provided which limit the flow of current in the various circuits to quantities of 1 1-3, 2 or 5 amperes. These fuses are provided with a visual and audible alarm which immediately indicates to the attendant an operated fuse. Immediate attention can then be given to determine the cause of the trouble.

The switchboards themselves are constructed of steel frames over which a wood covering is placed, the wood simply protecting the interior from dust and giving a good appearance. No more wood than is abso-

lutely necessary is ever used. All of the racks for holding the wires, cables and other pieces of apparatus are of steel. The boards themselves are divided into sections by means of steel screens. Each section of frame-work is sub-divided horizontally by means of steel screens so that the sections are in three parts.

If, in spite of the automatic fuses, or in case of accident or through carelessness, a fire should start in any particular switchboard section, the remaining portion of the switchboard and in fact the remainder of the particular switchboard section is cut off from fire damage by means of these screens.

It is generally necessary to run wires and cables from one floor to the other. In such locations a hole through the floor is necessary. Where such a hole is placed it is faced with steel and after the wires have been placed is closed completely by means of boards constructed of asbestos and cement.

Fire Fighting Apparatus.

For fire fighting purposes there is installed in every central office four different kinds of fire fighting apparatus: First, a pail filled with sand; second, an asbestos blanket; third, a fire extinguisher called a "dry gas fire extinguisher"; fourth, the well-known portable chemical fire extinguisher, (our last resort).

After providing all the various methods for protection against a possible fire without an adequate and carefully supervised system among the employes, without training them as to what to do in case of an emergency, the provision of this equipment, would be of little value. So that all our employes may know the uses of the fire protective apparatus, and be familiar with the steps to be taken in case of fire, complete instructions, including a system of fire drills have been issued.

An electrically operated fire bell system is provided for the notification of all employes that there is a fire. Immediately upon the sounding of the fire signal the operators leave their switchboards and march directly to a building exit and down the street. Various signals indicate what particular exit or groups of exits shall be used.

A diagram of each floor of the building is provided, which shows the various exits and line of march to be taken by the employes. The employes familiarize themselves, not only by looking at the diagram, but by actual participation in the fire drills as to best way to leave the building. We have the employes leave their work and leave the building. It was thought at one time that the nature of telephone service, particularly in the middle of the day when there was a large volume of business, was such that it would be impractical to give up the telephone service for a sufficient length of time to allow our employes to get to the ground and back again. We have now had this fire drill plan in operation for some months and have not experienced any serious service complaints. Generally the customers upon being advised of the reason for delay have been satisfied.

Regular stations, such as fire fighting equipment, fire escapes and other important points are assigned to the male employes, who go directly to these stations immediately upon the sounding of an alarm.

The duties of the various employes have been carefully studied and assigned so that there are employes to look after the fire doors and shutters, to look after the fire extinguishers, to assist in every way in the safety of the employes, to preserve discipline and to see that the various parts of the drill are carried out expeditiously and without disorder.

Over the top of the switchboard is a waterproof cover and an employe is assigned to see that this cover is pulled over the board should occasion ever be necessary. Other employes are to see that office records are properly removed, and still other employes take up locations at the fire escapes.

It is the duty of the particular man in charge of any one office to see that the city fire department is immediately notified in event of fire at any point of the telephone company's premises.

General hints in connection with fire protection, such as refuse, stoves, furnaces and oil and other combustible materials are also contained in the instructions.

In compiling these instructions and making them effective we have had several conferences with variout fire marshals and fire chiefs in cities where this plan is in vogue. In every case we have received a hearty endorsement and not only have the various fire chiefs taken considerable interest in our plan, but have rendered us material assistance through many valuable suggestions which they have made in connection with the provisions of adequate exits, the matter of seeing that fire doors can be readily opened by means of panic bolts instead of ordinary door knobs, the provision of adequate and safe fire escapes, and many other points. They have also learned that water is the last thing to be turned on in a telephone office.

These precautions are not necessary on account of telephone operating equipment representing a fire hazard. On the contrary fire insurance companies regard telephone buildings and their contents as a desirable risk. They are necessary because of the value of uninterrupted service to the public.

The safety of our employes, the complicated nature of the mechanical construction, the ease with which it may be damaged beyond repair through moisture or chemicals and the ever present possibility of uninstructed effort doing more harm than good, have been some of our principal reasons for spending considerable thought on fire and its prevention.

Such fires as we have experienced have usually occurred during the time that an equipment was being assembled or when an addition was being made.

It is necessary that we solder wires together or to pieces of apparatus. Bees' wax heated almost to the boiling point is used to saturate the ends of the cables. Paint and oils are a necessity. Artificial light has to be used.

We surround the work with every precaution. Smoking is prohibited. Insulated guards are placed over electric lights. Where portable gas furnaces are used for heating soldering irons, the rubber hose is incased with steel wire. Oils and paints are kept outside of the building in fire-proof containers.

Fortunately so far on the 'Pacific Coast we have escaped a serious fire in any of our offices, except, of course, in San Francisco at the time of the earthquake. This cannot be said, however, for other portions of the country.

During the month of March a serious fire occurred at Worcester, Mass. This fire rendered inoperative telephone service to about 150,000 subscribers and like some of our other fires we have never been able to determine exactly what caused it. The resulting damage occasioned as much work as the establishment of an entire new central office equipment. The work of repairs was completed in 9 days, and when it is known that there were nearly 20,000 telephone instruments connected to this switchboard handling over 1,000,000 telephone calls a day, the difficulty of the task which confronted the employes of the telephone company can, to a limited extent be realized by everyone. The particular building in which the equipment was located was undergoing alterations and the fire started in a portion of the building which was used by the building contractor as an office. Due to the temporary alterations which were then in progress, the fire spread rapidly to other portions of the building, which under normal conditions it would not have been able to reach.

The fire started at the time when there were few employees on duty, and through that cause gained considerable headway before it was discovered. The greatest amount of damage, however, was not done by the fire itself, but was done by the water, which was put on the burning portions of the cables. In justification of the fire department, however, there must have been upon its arrival a severe blaze in a portion of the equipment, and to one not familiar with telephone apparatus the action taken of pouring on a large quantity of water was in all probability justified.

Another aspect to the value of telephone service to a community is illustrated by what happened at Salem, Mass., during the time when Salem had its $15,000,000 conflagration in June of this year. The central office of the telephone company was not burned, but the telephone company lost about 1000 telephones and the long-distance cable plant was badly damaged and about 25 employes were made homeless.

A common desire to do everything possible for the benefit of the telephone using public, supplemented by a loyalty to the company that characterizes their work everywhere in great emergencies, was the spirit that dominated these employes and resulted in widespread commendation.

The faithfulness and heroism of the operators was remarkable. What they did in those trying hours during the fire and later makes one of the most dramatic stories of the conflagration. Their work was superb. It could not have been better. The homes of twelve operators were burned—one in every eight of the entire force of ninety-five. And yet for more than an hour these girls, with others, sat at the switchboards with coats and hats on and answered thousands of calls from excited subscribers while the great fire raged within five hundred feet of the central office and the lurid flames could be seen more than one hundred feet in the air. Although the front windows were too hot to touch, these young women remained at their work without indication of fright or nervousness. During the night they worked by the red light of the fire and lanterns after the electric and gas lights had gone out. Those who were in the operating rooms during this period and witnessed the work of these girls pay willing testimony that every one was a true heroine of the switchboard. Many knew their homes had been burned, or were in the path of the fire, and yet they continued their nerve-racking work as though nothing out of the ordinary was happening.

It was providential that the telephone central office was not burned, for the service was indispensable during the fire in summoning help from twenty-two cities and towns and calling over two hundred militiamen and a number of state officials. After the conflagration the service was of equal value, if not more so, as a means of quick communication for those engaged in the splendid relief work.

Early in the afternoon of Thursday, when it became positive to the city officials that the fire was beyond control, the first appeal was made to the telephone company for help. In response, operators were given the names of every member of the Second Corps of Cadets and of Company H of the Eighth Regiment. They went to work immediately, and in about one hour most of the men were at the armory and ready for guard duty.

Simultaneously, other operators were sending out the call for firemen and police in various places, and it was not long before fire apparatus and officers were coming to the stricken city from all directions. During the evening the central office was visited repeatedly by fire and police officials, who sent directions out over the wires from the chief operator's desk.

It is evident from the example at Salem that in event of a severe conflagration immediate steps should be taken for the protection of telephone plant and equipment in order that at the time of the greatest need the citizens may have ready means of communication.

Thus we see the telephone plays an all-important part in the daily life of any community. It is indispensable in an emergency. Therefore, in order that it may be available when needed the most, every possible precaution must be exercised to keep, not only the telephone buildings and central office plant in working order, but the entire distributing system serving every office. It is felt that the telephone companies are doing all in their power to bring this about, and with a better knowledge by the public of the peculiar conditions which apply to the maintenance of the telephone plant and their co-operation, we believe that the highest efficiency possible will be obtained in the telephone service, and the telephone companies will be able to realize their aim, "To furnish reliable and prompt telephone service and to deal courteously with everybody."

A library of petroleum literature has been established by the United States Bureau of Mines under the direction of W. A. Williams, chief petroleum technologist. The details of this work have been assigned to Dr. David T. Day, who has recently been transferred from the United States Geological Survey as petroleum technologist, and who will also assist in a thoroughly organized research into the chemistry of oils, which is being developed by the Bureau of Mines. The importance of such a library is so manifest that it is hoped all technologists will aid in the work by exchanging with the bureau all available books and maps on this subject.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

Section H—Meters.

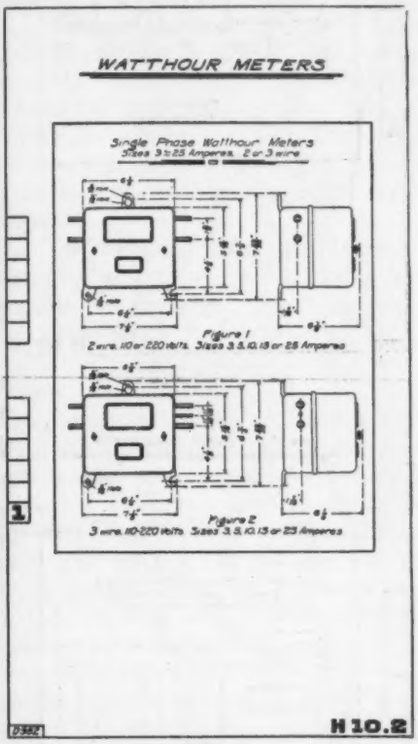
BY L. M. KLAUBER.

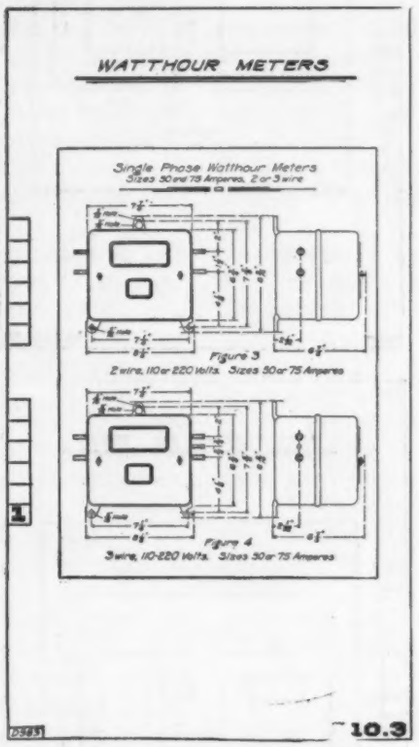
[Continued.]

The following items are treated in the handbook:

H 10 Dimension Sheets.
H 20 H.P. Calculations.
H 30 Test Diagrams.
H 40 Meter Constants.
H 50 Current Reading Loop.

H 10: Dimension Sheets. These drilling plans have been found of considerable use to meter setters. The schedule of meters covered is as follows:





H 10.1—Standard Watthour Meters. Sizes Used and Index to Dimension Sheets.

Single Phase.

2-wire--110 or 220 v. Size in Amperes.	Fig. No.	3-wire--110-220 v. Size in Amperes.	Fig. No.
3	1	3	2
5	1	5	2
10	1	10	2
15	1	15	2
25	1	25	2
50	3	50	4
75	3	75	4
100	5	100	5
5 round type	7	150	6
10 round type	7	5 round type	7
		10 round type	7

Three Phase.

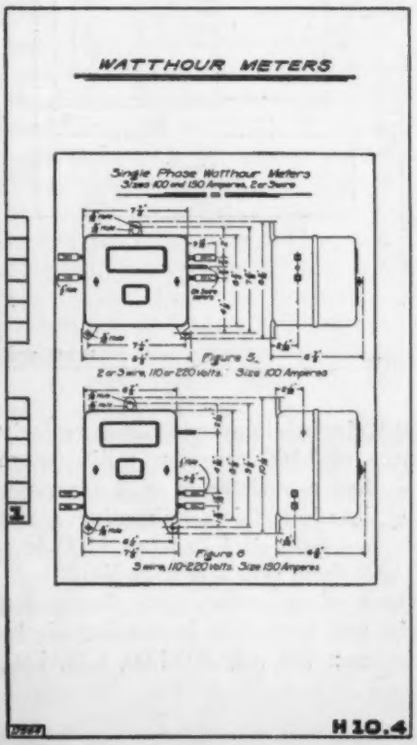
3 wire—220 or 440 v.

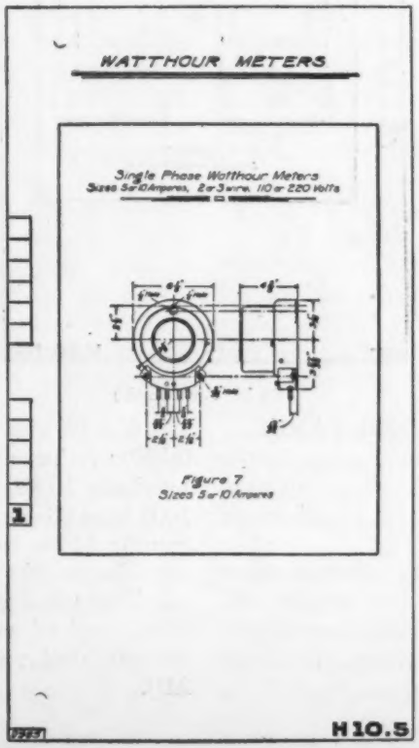
Size in Amperes.	Figure No.
* 5	8
10	8
15	8
25	8
50	8
75	8
100	9
150	9

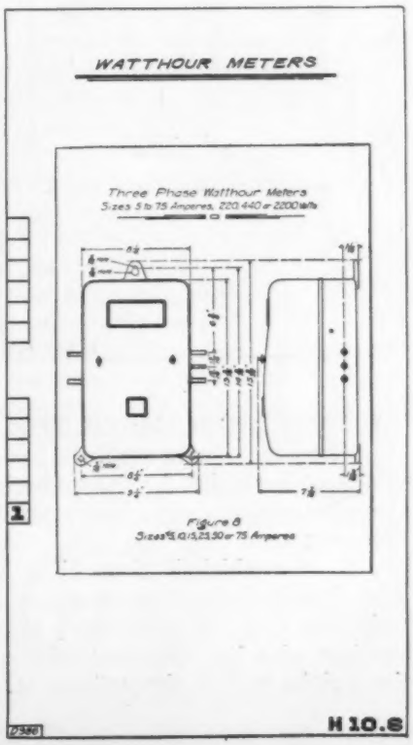
* Also used for 2200 volts.

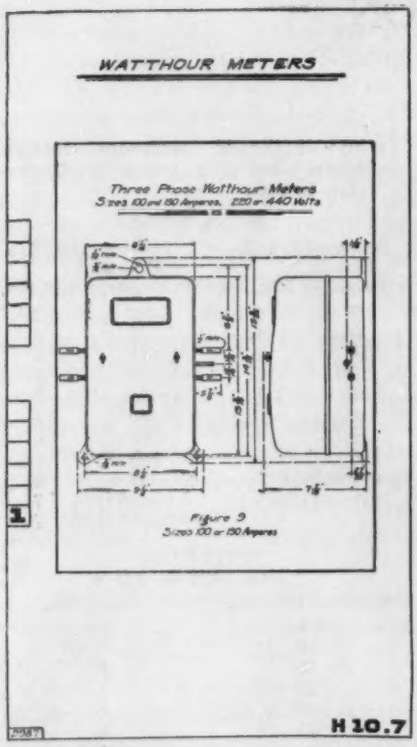
Direct Current.

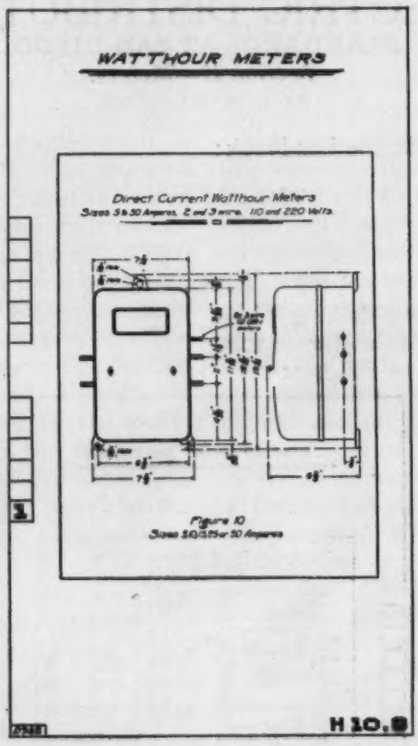
2 or 3 wire—110 or 220 v. Size in Amperes.	Fig. No.	2 wire—500 v. Size in Amperes.	Fig. No.
5	10	5	11
10	10	10	11
15	10	15	11
25	10	25	11
50	10	50	11
		75	12
		100	13
		150	13
		300	14

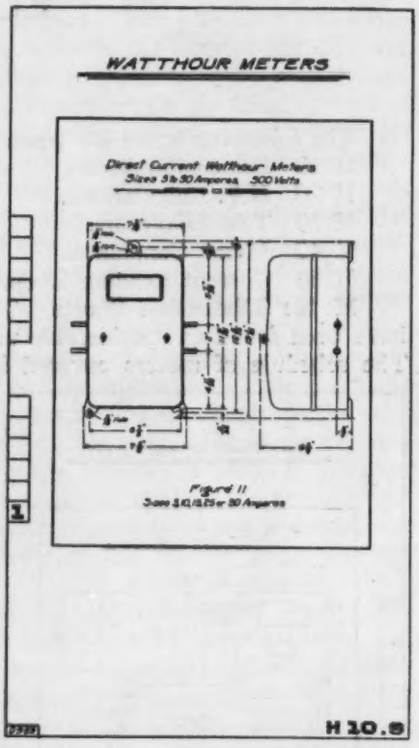


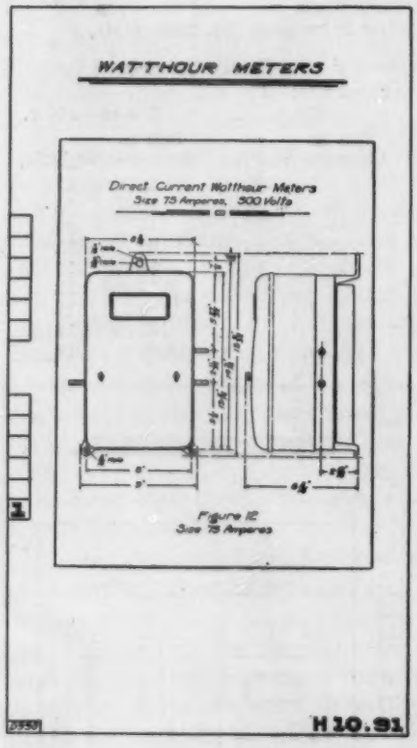


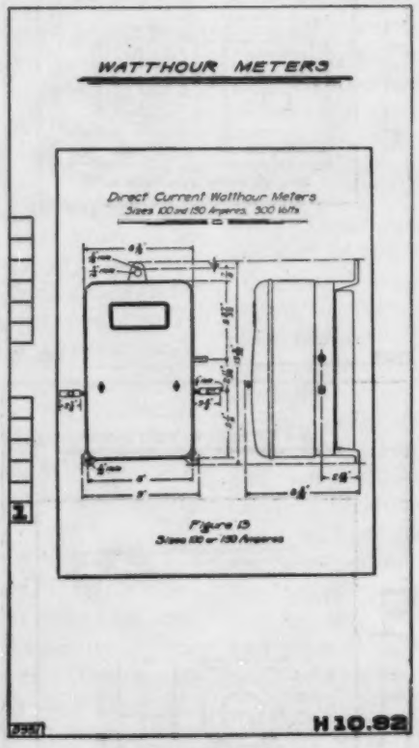


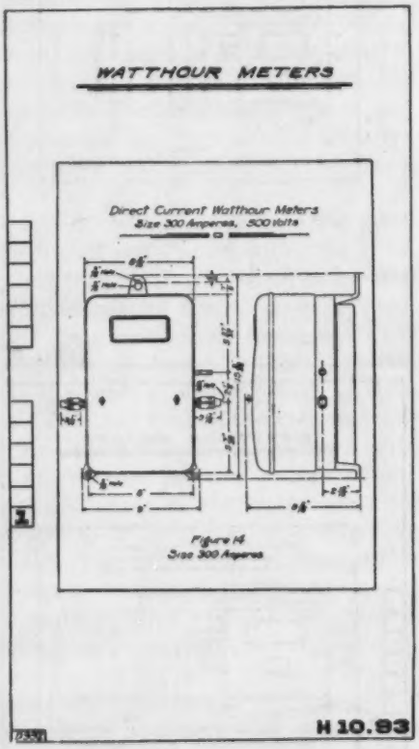

WATTHOUR METERS
Three Phase Watthour Meters
Sizes 100 and 150 Amperes, 220 or 440 Volts
Figure 9
Sizes 100 or 150 Amperes
H 10.7


WATTHOUR METERS
Direct Current Watthour Meters
Sizes 5 to 30 Amperes, 2 and 3 wire, 110 and 220 Volts
Figure 10
Sizes 10,15 or 30 Amperes
H 10.8









(To be continued.)

HOW TO REMEMBER THE WIRE TABLE.

The copper wire table, B. & S. gauge, has simple relations, such that by remembering a few constants the whole table can be constructed with approximate accuracy.

A wire which is three sizes larger than another wire has half the resistance, twice the weight and twice the area. A wire which is 10 sizes larger than another wire has one-tenth the resistance, 10 times the weight and 10 times the area.

No. 10 wire is 0.10 in. in diameter (more precisely 0.102); it has an area of 10,000 circular mills (more precisely 10,380); it has a resistance of 1 ohm per 1000 ft. at 20 deg. Centigrade (68 deg. Fahrenheit), and weighs 32 lb. (more precisely 31.4 lb.) per 1000 feet.

The weight of 1000 ft. of No. 5 wire is 100 lbs.

The relative value of resistance (for decreasing sizes) and of weight and area (for increasing sizes) for consecutive sizes are: .50, .63, .80, 1.00, 1.25, 1.60, 2.00.

LETTER TO THE EDITOR.

Los Angeles Aqueduct Mistakes.

Sir:—As you invite comment on Los Angeles aqueduct matters in your issue of October 24th, permit me to state as follows:

For a long time after the report made by the Peoples' Investigation Board, many people were in doubt regarding the facts. It has now become recognized, however, that the Board made an extremely conservative report, and there are few people of the class seeking to be informed in this city, who do not know that the Los Angeles aqueduct was a scheme to benfit real estate operators, in the San Fernando Valley, and not required for the city of Los Angeles.

There is no well informed hydraulic engineer in Los Angeles, who has resided here long enough to be familiar with conditions, and who is disinterested, to whom the fact is not known that the water resources available, before the aqueduct was constructed, can be made applicable for a city of 1,000,000 population. This fact is capable of absolute mathematical demonstration.

The future growth of the urban population in Los Angeles will nearly all be over irrigated areas, contiguous to the city. As these areas are cut up into lots, the water formerly used for irrigation becomes more than sufficient to supply the new domestic requirements.

Recently the people have also become convinced that the construction work on the aqueduct is much worse than was claimed by the People's Investigation Board. This has become apparent from the many disasters, which have befallen the work in spite of the fact that only a little water for short intervals, has been carried through the conduit.

A demand was made to have the work tested, by passing a full flow through the aqueduct for 60 days,and wasting the water into washes on the desert, which would readily absorb it, but those in charge of the water department have refused to make such a test. There is but one conclusion to be drawn, namely, that they are as well informed regarding the inferior work as those who criticise it. Their freedom from exposure depends on the length of time during which they are able to prevent the work from being thus tested.

During the present summer, a large volume of short duration was passed through 60 miles of channel above Haiwee Reservoir, for sluicing out debris washed into the aqueduct above this point. It did so much destruction to the concrete work, that it was discontinued, and extensive patching had to be undertaken to restore the concrete lining. The effect of this patching can be readily seen by observers, as the difference in color of the old and new work is easily distinguished.

In connection with this defective tufa cement the following quotations from the testimony of Mr. Edward Johnson, formerly a member of the Board of Public Works of this city, given before the Aqueduct Investigation Board, is illuminating:

"Question—Do you not regard tufa cement as strong or as hard as concrete made of straight Portland cement?"

"Answer—I do not consider it as good in any way, except that it is applicable to certain uses in which it might be used without any great harm. If I were building the aqueduct today, I would not use if anywhere. I do not think it would be worth the money you would save on it using it anywhere."

"Question—Do you think the expense in repairs and maintenance are likely in a very short time to more than eat up the $500,000 saved in the use of it?"

"Answer—I think they will, yes sir." (See page 73, report of Peoples' Aqueduct Investigation Board.)

There are two reasons why the aqueduct people do not admit the facts so generally known in this city, regarding the project and character of the work, as stated by Mr. Warner.

The first is, that the proprietors of the principal newspapers in this city are interested in the San Fernando Valley land speculations, and cannot afford to admit the facts, because it would hurt their private interests.

The second is that most of the people who know the facts, believe that an exposure of the truth to the outside world will injure the city of Los Angeles generally.

In regard to these I believe the first reason is well taken, as an exposure would injure the value and prevent sales of the San Fernando property. As to the second, however, I am strongly of the opinion, that to tell the outside world the truth, and set about to remedy conditions by making the San Fernando Valley speculators come through with money to make the aqueduct right, will eventually benefit the city more than to conceal the true facts.

The policy of secrecy now carried on is solely for the purpose of suppressing truth to aid in the sale of the San Fernando Valley property, which is not such a difficult matter to do with the support of the local press, and the active co-operation of the high salaried officials, in charge of the aqueduct, to cover up their mistakes and save their salaries. There are three men drawing jointly $27,000 per annum in salaries, to say nothing about their expense accounts and the numerous others, who receive smaller salaries, although the aqueduct work was reported to have been completed, and a celebration held a year ago.

While drawing these salaries, these men are devoting their time to rendering services for compensation to others than the city of Los Angeles, except when they are called upon to suppress the true facts concerning the Los Angeles aqueduct.

It is incredible, however, that the people of this city can much longer be fooled in this fashion, and yet a complete exposure is not likely, until the city becomes totally bankrupt. The reason for this is the false civic pride of so many people. Yet questions are now beginning to be asked, such as why it is almost a year since the completion of the aqueduct was celebrated and still no revenue from the project is in sight, although the city is contributing over $2,000,000 per annum in interest, sinking fund and maintenance.

In the meantime it is a pertinent question to ask, how the city of Los Angeles can develop any reliable power from an aqueduct, such as has been provided.

Personally I called attention to these pitfalls and the unwisdom of doing cheap and inferior construction work years ago, when there was still time to avoid these mistakes. For this I received nothing but

abuse from those who were profiting by the undertaking. This, however, makes no difference, as the truth is mighty and will eventually prevail.

Conditions are now so apparent that an expert observer can go over the aqueduct and see for himself, and any person of ordinary education can go over the accounts of the aqueduct and water department in this city and see that these departments are both bankrupt.

Respectfully,

F. C. FINKLE.

Los Angeles, Cal., Oct. 27, 1914.

FACTS FOR SETTLERS.

"Some Things the Prospective Settler Should Know."

This is the weapon the University of California has placed in the hands of the newcomer to the state and of the man who has heard the call, "Back to the land!"

Here is a free publication of the College of Agriculture telling what it costs to go to farming, how much investment a competent farmer must make to get a reasonable living, how much yield of each of the standard crops of California may on the average be expected, and how large an acreage is on the average needed to support a family from each of the various types of California agriculture. Dean Thomas F. Hunt and the best experts of the agricultural faculty have combined in this publication their experience, knowledge, and judgment.

A man who can grow only the "average crop" is here warned that, generally speaking, he will do better working for a daily wage for others.

On the other hand, the settler is advised not to figure on raising more than two-fifths of the maximum yield possible in the neighborhood in which he is to locate.

So, for example, the average yield of barley in California is here stated as 25 bushels to the acre. A hundred sacks is declared possible, but extraordinary. A competent man may hope to raise 50 bushels. But a safe basis for figuring, for business purposes, would be 40 bushels.

For potatoes, 125 bushels is stated as an average, 200 as a good yield, and 175 as a safe estimate; for Muscat raisins the figures given are half a ton, a ton, and three-quarters of a ton to the acre; for butterfat per cow per annum, 150 pounds, 300 pounds, and 225 pounds; for alfalfa, 3½ tons, 6 tons, and 5 tons, and so on for all the great standard crops of California.

How large must a farm be to furnish a satisfactory living?

What a satisfactory living is one must decide for himself, but to earn a gross income of $4000 a year the acreage needed, figuring on a safe basis as before, would vary according to the comparative table given, from a dozen acres for orange trees in full bearing to 33 for onions or potatoes, 60 acres for dairying, 91 for rice, 100 for alfalfa-raising, 167 for barley, or 235 for wheat. Of the gross income, a large share would represent interest on the investment, another large share would go for expenses, and a moderate share remain as remuneration to the farmer and his family for their work. And of course figures as to yield and acreage vary greatly for differences in land and differences in skill.

Children are a material asset to the farmer, here declares Dean Hunt. Their labor is an advantage not only to the family income, but "because this training in contributing to the family income which they receive before the age of 21 is one of the most valuable assets these children can acquire."

Here are some of the warnings to the settler now sounded by the College of Agriculture of the University of California:

Don't figure too high on prospective yield.

Don't figure too low as to the amount of land you'll need.

Don't expect to make a satisfactory living at dairying on twenty acres.

In selecting land be sure the soil is deep and well drained. Hardpan and alkali go along with lack of proper drainage.

Consult the University and United States soil surveys, when available.

Remember that the sale of land for purposes for which it is not adapted has caused great losses and great misery, so be sure the land is suited to the crop to be grown.

Watch out that the land title is secure.

And in buying land remember that no law can furnish men with judgment.

"Probably nothing can make a man keen in a horse trade save experience," says Dean Hunt.

A striking statement is that the average size of California farms is 317 acres, and their average value is $16,447, yet three-fifths of the farm land in California is held in tracts of a thousand acres or over. These seventeen million acres, however, are only five per cent of the number of farms. One-fourth of all California farms are less than 20 acres in area, one-fourth between 20 and 49 acres, one-fourth between 50 and 174, and one-fourth of 175 acres or more.

After discussing climate, soils, irrigation, farm labor problems, "how to start," and the affairs of the man who rents land, this publication concludes with a special discussion of each of the standard crops of California, written by a special authority in that special field. These tell of where to see the particular industry to best advantage, objections to the crop, things to avoid, methods in use, methods of renting, marketing conditions, land and rental values, etc.

The crops thus specially discussed are alfalfa, almonds, barley, beans, citrus fruits, cotton, figs, grapes, olives, onions, pears, prunes, potatoes, semi-tropical fruits, sugar beets, and walnuts.

This publication, which promises to be of inestimable value to those who want to make their home in the open country in California, can be had for the asking by writing to the University of California at Berkeley.

THE PURPOSES OF NATIONAL FORESTS AND THEIR PROTECTION.

BY CHAS. H. FLORY.

(This paper was read before the Oregon Society of Engineers at a luncheon on October 12. The author is assistant district forester at Portland.—The Editor.)

A noted French writer once remarked that "In its forests lies the heart of a nation and a people without forests is very close to extinction."

Once, Tripoli was clothed with abundant vegetation which secured the stability of the soil, making it possible to establish cities surrounded by prosperous cultivation. It formed then one of the granaries of the Roman Empire; now we find but the desert and ruins. The whole of this plain has become sterile, owing to the disappearance of the forests of the interior. Today only a few places are found which will support a few fields of barley and other grain for the meagre maintenance of miserable and decimated tribes. It is said that the present condition of the whole of northern Africa is the result of the ceaseless devastation of its forests. Central Asia, once a garden of exceptional fertility, is now a desert. In King Solomon's time, the mountains of Palestine were clothed with "Cedar's of Lebanon" and the land, "flowed with milk and honey." Today only a few small groves mark the remnant of a once vast forest and the land will hardly support the remaining nomadic tribes.

The famine and pestilence which sap the life of China can be largely traced to the wasting of its forests. The president of Baptist College, Shanghai, states:

China's hills and mountains are deforested. This is particularly true in the hilly country drained by the Yangtse River. * * The river brings the soil down with it. That is the reason why we have the Yellow Sea. For 300 miles out from land the ocean is discolored by the silt brought down by the Yangtse.

These countries have paid the price of the early dissipation of their forests in the present wastes of sand and sterile lands. Perhaps changing climate has to some extent been the cause, but it is evident that the present situation is largely due to complete forest removal.

These are extreme examples to be sure and it is hardly possible that the United States ever will be reduced to a state of poverty through senseless wasting of its timber resources, but they point a moral, in that economy should ever be our watchword. Conservation does not mean preserve and not touch, but occupy and use; but use wisely.

Our national Congress very early saw the necessity for economy of its timber resources. One hundred and fifteen years ago, the first act was passed which provided for the purchasing of lands and the growing of timber suitable for use by the navy.

Since then, as the public gradually awakened to the realization that many of our natural resources were being ruthlessly destroyed, Congress has passed many acts, all tending to encourage economy and judicious use of the vast stores of natural wealth which a bountiful nature has bestowed upon us.

Finally, in 1891 an act was passed whereby vast areas of timbered lands in the mountain ranges of the West were withdrawn from private entry and set aside for the use of the general public. The management of these lands, now known as National Forests, justifies the existence of the United States Forest Service.

No plan of forest management can be successfully carried out unless adequate preparation has been made for protection against fire; this is absolutely fundamental. In a few hours fire can destroy timber that has required hundreds of years to grow. It is obvious that the forester who must wait a hundred years or so for trees which he plants to reach maturity, would be exercising the rankest kind of folly in maintaining nurseries, conducting reforestation on large scale, and establishing long periods of scientific treatment to assure a future supply, if he made no effort to prevent his labors from going up in smoke. A burned city can be rebuilt in a few months but it takes a lifetime to grow a forest. If the forest crop is to be harvested it must be protected constantly during the time of its growth. It would seem from the importance which the lumber industry plays in the development and economic welfare of the entire country that the necessity of fire protection would receive as much conscientious thought on the part of the public, as the protection against fire in our cities. Millions of dollars are annually spent and carefully drawn laws are rigidly enforced for the protection of property in cities and towns, but there is a woeful lack of effort or even interest in many localities toward one of the most vital problems of our day—that of protecting and conserving the remaining timber so that a perpetual future supply can be assured.

In spite of the fact that the federal and state governments and private associations are spending hundreds of thousands of dollars each year for fire protection approximately seventy-five per cent of all fires are caused by man's carelessness, the remaining twenty-five per cent being caused by lightning over which we have no control.

Fortunately, however, due to the persistent campaign of education which the various fire protection agencies have been carrying on during the past two or three years, the public conscience is awakening from a state of apathy regarding forest fires. Only a short time ago we looked upon forest fires as unavoidable as storms, financial depression, and taxes. The annual visitation of fires in our timbered regions was accepted as inevitable. No one ever gave a thought to their suppression or prevention. We knew they were deplorable and caused suffering, loss of property and death. Yet in our minds we knew that the terrible fires which have ravaged our timber could have been prevented if they had been extinguished in their incipiency. But as is so often the case, what is everybody's business is nobody's business.

We are beginning to realize now that we individually share in the loss of timber destruction, and that it is the business of each one of us to help. Of each thousand board feet of timber destroyed in the state of Oregon, if the owner loses say $2.00, there is a direct loss to the public in wages, supplies, etc., of about $8.00. The owner is always the smaller loser. When we fully realize this fact we can understand that forest fires are unnecessary, useless, and a menace to our industrial welfare.

At certain seasons fire is an ever-present danger on the National Forests. The great size of the Forests compared with the number of the patrolling force, the difficulty of reaching remote areas across miles of wilderness, the dry air and light rainfall in parts of the West, the prevalence of lightning in the mountains, and the constant use of fire in the daily life of the people and in the industries all combine to make the hazard exceptional.

Among the chief causes of fire are railroads, lightning, campers, slash-burning, incendiarism, and steam sawmills. The great fires of 1910, which swept Idaho, Montana, Oregon and Washington, destroyed many millions of dollars worth of timber and 85 human lives and cost the United States nearly a million dollars in fire-fighting. Like all other great conflagrations, these began, with small fires which were fanned into fury by gales of wind. A small fire may at any time spread into a conflagration, and fires, matches, and burning tobacco should be used as carefully in the forest as they are in the home. Carelessness in this respect may mean the loss of lives, homes, stock, and forage, and of a vast amount of timber which belongs equally to all citizens.

Fires may start in a region remote from supplies and water and reach vast proportions before a party of fire fighters can get to the scene, no matter how promptly the start is made. By far the best plan, therefore, is to prevent fires rather than to depend upon fighting them once they start. This subject has been given the most earnest attention by the Forest Service. During the danger season the main attention of supervisors and rangers is devoted to preventing fire. Many men are employed, the forests are systematically patrolled, and a careful lookout maintained from high points. Roads and trails are so built that every part of the Forest may be quickly reached with pack animals. The ranger stations and lookout points are connected with the offices of the supervisors by telephone, so that men may be quickly assembled to fight a dangerous fire which the patrolman can not subdue alone.

During the past few years the Forest Service has constructed over 2200 miles of trails and nearly 2500 miles of telephone lines in the state of Oregon for the purpose of affording rapid communication in times of danger. Over seventy-five high mountain peaks and exposed ridges have been chosen at strategic points, on the tops of which a lookout man remains night and day throughout the fire season. He is furnished with a house and supplies are brought to him by a patrolman. He is equipped with a telephone, or heliograph, and a fire-locating device by which he can accurately locate any visible fire. He is required to report to his supervisor at regular intervals throughout the day as to general conditions as he sees them, and reports at once any fire discerned. The lookout system has proven to be the most efficient of all means of fire discovery and location, and is being very rapidly extended over the entire mountainous regions of the West.

There is an old Arabic adage that if the house is on fire, and there are but three minutes in which to save the contents, two should be employed in planning what to do. This is alright in a way and would no doubt often save a costly mirror being thrown out a window while the feather bed was being carried down stairs; but when a forest is on fire the situation is different. Owing to the fact that fire often starts miles away from immediate means of communication in a wilderness difficult of access, it is absolutely necessary that we plan far in advance just what to do in case a fire starts. Each year, before the fire season begins, arrangements are made with loggers, millmen, employment agencies, etc., for the immediate supplying of certain numbers of men upon an instant's notice. Reliable ranchers, settlers, or other residents in the neighborhood of the forests are engaged to act as foremen of fire-fighting crews when called upon. Stores, logging commissaries, hotels, etc., are selected to furnish equipment, supplies or meals. Arrangements are made with livery stables, garages, and settlers to furnish a given amount of transportation. The telephone number of every settler in the county is known and listed. At convenient places all over the forests tool boxes are constructed which contain a supply of axes, shovels, crosscut saws, water bags, provisions, grain, etc., for use in fire fighting. All such boxes are shown on a map of the district over which a ranger has charge. All these various things are known to the ranger and he systemizes them into a fire plan so that when a fire is reported to him from one of his lookout men he knows exactly what to do. In other words eternal preparedness is the rangers' slogan.

The past season proved the soundness of this fact beyond all question. Not in years have we had such a prolonged dry hot summer. In many years the fire season was more serious than the memorable one of 1910. Probably a thousand fires started in the state of Oregon this summer, but practically no green timber was killed or destroyed. Therein lies the acid test of a fire-fighting organization. It is the prevention of timber destruction and not what it costs to fight fires that determines our efficiency. It cost us $124,000 to extinguish the fires in the National Forests in Oregon and Washington during the past summer, but we saved from destruction millions of dollars' worth of the finest timber that grows. But in this connection, I want to give credit to the many hardy pioneers who, living far back in the sparsely settled mountainous regions, gave us their hearty support and co-operation during one of the most critical periods of our history by helping defend the nation's property from the enemy fire.

The Forest Service is often accused of being out of sympathy with the settler and that we do not welcome him among our midst. This is not so.

The National Forests are being classified as rapidly as possible to segregate the lands chiefly valuable for agriculture, and make them available for homeseekers. Whenever considerable bodies of such land are found, they are either eliminated from the forest or are listed with the Secretary of the Interior, to be opened to entry under the forest homestead act. The bulk of the agricultural land in the National Forests occurs as scattered individual tracts along streams, the bottom of ravines and swales, and on narrow benches and on the base of slopes. Although I must add that most of the valuable agricultural land has

already been settled upon. These scattered tracts, which may be used to build up a home, are sought out and settlement encouraged. Home-seekers may apply for tracts which may seem to them to offer the opportunity for a farm. These areas applied for are given the preference in the classification work, and are examined as expeditiously as possible. If found chiefly valuable for agriculture and not needed for public purposes, they are listed with the Secretary of the Interior to be opened to entry.

The use and occupancy of the agricultural lands in the Forests is desired from every standpoint. Every added home helps in the upbuilding of the country. The forests are to serve the people in the permanent development of homes and industries. In addition, the settler is a great help—practically a necessity—in the protection and development of the forest itself. Every strip of cleared land is a fire-break; every ranch is a vantage point to prevent and fight fires; every settler may become a forest protector.

If time were available I should like to tell you more about the daily activities of the Forest Service, how we sell and market the timber that is ripe for cutting, how we guard the streams and keep them running pure from the public fountains on our street corners, how we utilize the grass and weeds in our forests in the support of hundreds of thousands of sheep, cattle and horses, how we gather seed and grow acres of little trees to later reforest old burns, how we make laboratory tests of the strength of various kinds of timber and search for new species of trees as substitutes for those fast disappearing, what we are doing for the good roads movement and how we are helping to maintain the country schools; and finally, how we are making available for recreation and pleasure a vast new and unknown country almost at our doors. Nowhere in the world can there be found such wonderful mountain scenery and such fine camping and hunting places as within the National Forests. All within a few hours' ride of Portland. In other words, the National Forests are the national playgrounds. They await your coming either for business or pleasure.

RULES FOR RESUSCITATION.

In line with its campaign to reduce the number of deaths in the mines of the United States, the Federal Bureau of Mines some time ago appointed a committee of eminent physicians and surgeons to develop an efficient method of resuscitation to be administered by miners or other persons to a fellow-workman overcome by electric shock or by gases in places which cannot be reached by a physician or surgeon in time to save life.

As a result of this committee's report just made, the Bureau of Mines, through Director Joseph A. Holmes, recommends the following procedure in rendering first aid to those in need of artificial respiration.

The recommendations apply not only to men who are overcome by electric shock or gases in mines, but also to persons suffering from the effects of illuminating-gas poisoning or from electric shock anywhere. The recommendations are, therefore, of importance to many thousands of workmen:

In case of gas poisoning, remove victim at once from the gaseous atmosphere. Carry him quickly to fresh air and immediately give manual artificial respiration. Do not stop to loosen clothing. Every moment of delay is serious.

In case of electric shock, break electric current instantly. Free the patient from the current with a single quick motion, using any dry non-conductor, such as clothing, rope, or board, to move patient or wire. Beware of using any metal or moist material. Meantime have every effort made to shut off current.

Attend instantly to the victim's breathing. If the victim is not breathing, he should be given manual artificial respiration at once.

If the patient is breathing slowly and regularly, do not give artificial respiration, but let nature restore breathing unaided.

In gas cases, give oxygen. If the patient has been a victim of gas, give him pure oxygen, with manual artificial respiration.

The oxygen may be given through a breathing bag from a cylinder having a reducing valve, with connecting tubes and face mask, and with an inspiratory and an expiratory valve, of which the latter communicates directly with the atmosphere.

No mechanical artificial resuscitating device should be used unless one operated by hand that has no suction effect on the lungs.

Use the Schaefer or prone pressure method of artificial respiration. Begin at once. A moment's delay is serious.

Continue the artificial respiration. If necessary, continue two hours or longer without interruption until natural breathing is restored. If natural breathing stops after being restored, use artificial respiration again.

Do not give the patient any liquid, until he is fully conscious.

Give him fresh air, but keep his body warm.

Send for the nearest doctor as soon as accident is discovered.

The members of the committee reporting to the Bureau of Mines are as follows: Dr. W. B. Cannon, chairman, professor of physiology, Harvard University; Dr. George W. Crile, professor of surgery, Western Reserve University, Cleveland, Ohio; Dr. Joseph Erlanger, professor of physiology, Washington University, St. Louis; Dr. Yandell Henderson, professor of physiology, Yale University; and Dr. S. J. Meltzer, head of the department of physiology and pharmacology, Rockefeller Institute for Medical Research.

The penetrating power of an X-ray tube depends largely upon its vacuity. A high vacuum, or "hard," tube emits a few rays of great penetrability, a low vacuum, or "soft," tube gives more rays of less penetrability. A pinkish light indicates too low a vacuum, a greenish-yellow light normal conditions, and the absence of glow indicates too high a vacuum. From 50,000 to 100,000 volts is necessary for the operation of the tube. The transparancey of a substance to X-rays is aproximately inversely proportional to its specific gravity, the transparancy of water being unity. Thus platinum is 100 times more transparant than pine wood.

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Cost Finding

It is high time to stop fault-finding about business conditions and begin cost-finding. This applies to every branch of the electrical industry, but particularly to the contractor, if any profit is to be gained from the lessons of the past and opportunities which the future now offers.

In the keen competition of modern business a minimum of cost is essential to a maximum of profit. Costs must be known before they can be minimized. Yet how few really know how to find their costs.

Not realizing that each business requires individual study, many a firm has installed a so-called cost system and tried to fit their business to the system instead of adapting a system to their business. After a period dependent upon the patience of the management the system is usually discarded and the costs are again approximated.

Costs are based upon facts, not theories. Guesswork never finds costs nor do round numbers roll into round dollars. To guess is to gamble.

Ignorance of costs not only ruins the ignorant individual but also hurts the entire industry. The man who bids too low because he does not know his costs not only loses money himself but also prevents others from making money. Furthermore there is always a new fool to rush in where he has some angel to back him. Consequently those who have learned how to find their own costs would do well to give the fullest publicity to what they have learned in order to prevent others from ruinous under-bidding.

There are a few general principles that govern all methods of cost finding. These include the segregation of all expense items into material, labor and overhead, and their allocation into a scheme of statistical records showing the results of past operations. From this it is possible to find the cost of each individual article or act, to find what lines of endeavor are paying and to predict future operations.

But it is necessary that each business be studied independently and a method be adopted to meet its peculiar needs. Some businesses require a more detailed analysis than others. There is as much danger from too many cost data as from too few. Information which is not used represents wasted money. There must be judgment in the installation and use of any system.

A cost system, while it has little or no relation to the general financial accounting of a business, can be used to advantage in furnishing much of the information from which the general financial statement is condensed. This interlocking of accounts should be of especial value to central stations, where the manager must know when and why the losses as well as the profits occur. A modern business without a cost-finding system is like a ship without a rudder and in these days of strenuous competition is in danger of going on the rocks of failure.

Faith in Action

No saying of recent times has been subjected to more ridicule than President Wilson's statement that our financial troubles are psychological. While ridicule is one of the strongest weapons of offense, it is not necessarily in the right. Careful analysis demonstrates that there is more truth than fiction in his much-quoted opinion as to the cause of the hard times.

In the first place "psychological" does not mean imaginary, as the jokesmith would have you believe. Because a value is intangible does not make it less real. Everyone concedes that business is now in a negative cycle, which has succeeded and precedes a positive cycle. The business depression is an admitted reality. But present fact is the effect of some preceding cause.

That cause was primarily lack of confidence. It began with a lack of confidence in the political party in power. Without arguing whether this was justified by act or threat the fact remains that financial men in the East had little faith that their interests would receive fair treatment. This lack of confidence has been augmented by the fear engendered by the European war.

Yet both doubt and fear are only temporary. A reaction of confidence and courage is inevitable and those who are best prepared will profit most. Already the exports of bread-stuffs have exceeded all previous records, crops have been good and a ready market is assured for all our products.

Particularly is this true in the West, where the natural resources are just beginning to be developed. As a consequence, the people of the West are undaunted in their faith of an early and favorable outcome.

It is easy enough to have faith after a thing has been demonstrated. The credit belongs to those who have the courage of their convictions and whose faith is reinforced by action based upon the assurance that history repeats itself and the belief that we are now on the verge of an unprecedented era of prosperity.

Doubt listens to the discouraging reports which faith does not believe; doubt looks discouraged, while faith is cheerful in the face of disaster; doubt is fearful, faith is courageous. Passive submission will never bring success. Determination, purposeful will, converts faith into action.

Faith in action is enthusiasm. Let us therefore be enthusiastic. The poor timber has been eliminated from every organization, finances have been dehydrated and every business is stripped and ready for effective action. Enthusiasm is contagious. Like magnetism it can be induced in others, strengthening rather than weakening our own. If we enthuse over prosperity we will soon be prosperous, if we think and act poverty, we will never be prosperous.

Enthusiasm is one of the greatest assets which a man can possess. It convinces and dominates capital, it overcomes prejudice and opposition, spurns inaction and in the end it gets results.

The Value of a Mistake

Mistakes are made by everybody. They should be regarded not as a matter of shame, but as a subject for correction. They should be carefully analyzed as to cause in order that they may be avoided in the future. A man that never made mistakes never made anything else—the main thing is not to make the same mistake twice.

Every man should also regard it as a duty and a privilege to tell others of the how and why of his mistakes so that they may likewise avoid them. Such is the advice that a father gives to his son. The unnecessary duplication of mistakes is an economic crime which can be obviated only by full publicity.

Concealment of a mistake is a selfish impulse. It is a false pride that allows a man to tell only of his successes and to gloss over his failures. Most successes have been built upon the lessons learned from previous failures. A broad man not only learns from his mistakes and from the mistakes of others but is also willing that others may have the benefit of his experience.

These thoughts have been brought to mind by the query as to what is to be gained by calling attention to the alleged mistakes in the construction of the Los Angeles aqueduct.

It is argued that the city eventually will benefit from this water supply and that no useful purpose can be served by giving publicity to the mistakes associated with it. It is also stated that much of the dissatisfaction has been instigated by the cement interests because their product was not used in its construction. Yet there has, as yet, been no authenticated proof that the findings of the investigating board were not true. If they should be forthcoming they will be accorded the same publicity which is now being given to the accusations of poor engineering practice. The columns of this journal have always been open to both sides of any discussion in order that the readers may draw their own conclusions.

It is the function of a technical paper to mirror rather than to mold public opinion, always with the ultimate purpose in mind of educating the reader. Young men, particularly, need as much instruction on how not to do things as on how to do them. Many an executive holds his position, not because of what he does, but because of what he does not do.

The experience of Los Angeles should be a warning to other municipalities in the acquisition of a water supply. From time to time it is hoped to publish in these columns other examples of how not to do things, all with the broad, generous purpose of helpfulness in mind. It is not the purpose to select any particular piece of work as a shining example, but rather to investigate the weak points of all work. Contributions in this vein of constructive criticism are invited.

PERSONALS

A. H. Babcock, consulting electrical engineer Southern Pacific Company, is in Arizona.

H. M. Byllesby, president, and **O. E. Osthoff,** vice-president of H. M. Byllesby Company of Chicago, Ill., are at San Francisco.

P. D. Callahan, Faries Manufacturing Company, of Decater, Ill., is a recent business visitor at San Francisco.

W. P. Naser, representative Trumbull Electrical Manufacturing Company, is a recent business visitor at San Francisco.

C. E. McNeil has resigned as local manager of the White Salmon, Wash., plant of the Pacific Power & Light Company.

E. C. McBrearty, representative of the American Electrical Heater Company, is at San Francisco from Detroit, Mich.

Gerald Porter has been appointed assistant chief engineer of the B. C. Electric Railway Company at Vancouver, B. C.

J. W. Little, superintendent of the Ramsay Street Railway System of Ramsay, Ill., is a recent business visitor at San Francisco.

C. W. Yerger of the Los Angeles office of H. B. Squires Company of San Francisco has left for the East on a short business trip.

F. E. Newberry of the F. E. Newberry Company has returned to Los Angeles from an extended trip throughout the Pacific Coast.

M. J. Hixon, salesman of General Electric Company, San Francisco, returned the first part of the week from a business trip to Nevada.

C. H. Carter, manager of the Pacific States Electric Company was at San Francisco during the past week to attend the wedding of his sister, Miss Madeline Carter.

C. E. Johnson of the American Ever Ready Works of the General Electric Company, is visiting the trade in the Pacific Northwest. His headquarters are at San Francisco.

G. H. Heyer, railway sales engineer for the Western Electric Company, is visiting the Pacific Coast from New York. He left San Francisco this week to go to Los Angeles.

H. F. Yost, representative Electric Railway and manufacturers' Supply Company of San Francisco, has recently returned from an extended business trip throughout Nevada.

E. C. Leighton, Seattle, has been awarded the contract for the wiring and lighting of the Hanford Street Warehouse by the Seattle Port Commission. The contract price was $4035.

W. Brewster Hall, representative of Pass & Seymour Company, San Francisco, arrived in that city the first of the week, leaving immediately for a business trip to Salt Lake City.

H. E. Sanderson, Pacific Coast manager Bryant Electric Company at San Francisco is making a business trip throughout the Northwest. He expects to return about the last of this month.

H. W. Kent, one of the most popular electrical men in Western Canada, has been appointed manager of the Vancouver branch of the Northern Electric Company, vice Mr. Roeder, resigned.

J. B. Challis, engineer with the conservation branch of the Canadian Department of the Interior, has returned to Ottawa after investigating water power records and statistics in British Columbia.

D. A. Reed, counsel for the United Railways Investment Company of Pittsburg, Pa., the holding corporation for the United Railroads of San Francisco, is a recent business visitor at San Francisco.

J. E. Adams was elected president of the Stockton Terminal & Eastern Railway at a recent meeting; also **C. M. Prater** was elected auditor and traffic manager; directors, **H. J. Kennedy, D. F. Owens, Francis George, Mary Turner, M. L. Scott** and **Theo. C. Bee.**

T. J. Pace, manager of the arc lamp division, and **J. G. Miles,** manager of the supply division, Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., were arrivals at San Francisco during the week.

F. H. Leggett, Pacific Coast manager for the Western Electric Company, has returned to San Francisco from Atlantic City, where he attended a meeting of the district managers of the Western Electric Company.

Theodore Powers, former manager of the Pacific Power and Light Company, at Waitsburg, Wash., has accepted a position with the Portland, Eugene & Eastern Railway Company at Portland, effective January, 1915.

George R. Cooley, an electrical engineer of Seattle, who is also a councilman, has introduced a bill in the city council which will require the filing of a bond for $1000 for each installation or extension of electrical wiring work. The intent of the bill is to limit electrical work to those electrical contractors who are in a position to furnish a bond of $1000.

W. L. Goodwin, vice-president of the Pacific States Electric Company; **R. M. Alvord,** manager detail and supply department General Electric Company, and **S. B. Gregory,** Pacific Coast manager Arrow Electric Company, are among those who plan to be at Los Angeles during the meeting of the executive committee of the California Electrical Contractors' Association, November 13 and 14.

Frank W. Hall has been appointed sales manager of the Sprague Electric Works, New York. Mr. Hall has been associated with the Sprague organization for the past nineteen years, occupying various positions of responsibility in the engineering and commercial departments. More recently he was manager of the Philadelphia office and subsequently manager of apparatus sales at the general office of the Sprague Works.

OBITUARY.

Louis Metzger Clement, a well-known civil and mechanical engineer in the West, passed away October 29th at his home in Castro valley, near Hayward, California. He was 72 years old and besides his widow, Charlotte E. Clement, he is survived by a son, Russell M. Clement, former city engineer of Oakland, and three daughters, Mrs. J. S. Maynard of Hayward and the Misses Maude and Gladys Clement. For a quarter of a century and more the name of Louis M. Clement was linked with all the big railroad building achievements west of the Rocky Mountains. He was engineer in charge of construction of the Central Pacific Railroad through the Sierras from 1861 until its completion in 1869. While with the Central Pacific he established the first patrol in the mountain snow sheds and built the first electric tunnel signals, as well as inventing the first emigrant sleeping car ever used by a steam railway. Later he designed and constructed the Hayes street cable road in San Francisco and built the Telegraph avenue street car line, one of Oakland's first electric railways. Afterward he was consulting engineer for Stanford University and the Southern Pacific.

Clement was a native of Canada, being born at Niagara. He was prominent as an engineer there before he started on his journey of 149 days to California with a pack train. He built the Montreal waterworks and several Canadian railways.

MEETING NOTICES.

Engineers' Club of San Francisco.

The annual dinner of the Engineers' Club was held in the club quarters in the Hotel Sutter on October 30th, with an attendance of over 80 members. The various reports showed the club to be in a prosperous condition with nearly $5000 in the bank and 300 members. An extended discussion was held and a committee appointed to investigate renting permanent quarters in the Hotel St. Francis. The regular ticket of the nominating committee was unanimously en-

dorsed, the following being elected officers for the ensuing year:

President, W. W. Briggs	Treasurer, A. H. Griswold
1st Vice Pres., Thos. Morrin	Secretary, G. R. Murphy
2d Vice Pres., E. B. Bumstead	Directors, Frank H. Varney
	W. H. Shockley

W. W. Briggs, as chairman of the entertainment committee had provided a number of vocal artists, who added much to the enjoyment of the evening.

Alameda County Electrical Development League.

The Alameda County Electrical Development League, composed of representatives from power companies, electrical jobbers, manufacturers, dealers, contractors and telephone companies, etc., held its regular monthly meeting at the Key Route Inn, Oakland, Cal., on Saturday afternoon, October 31st, at 1:15 o'clock. The league took up several important matters for the improvement of electrical work in general, and were favored by a lecture by Mr. F. F. Barbour of the Pacific Gas & Electric Company of San Francisco, covering the electrical work of installation and illumination of the Panama-Pacific International Exposition at San Francisco. The league unanimously endorsed the adoption of the Alameda County bonds for participation in the Panama-Pacific International Exposition at San Francisco in 1915. The league is doing good work in the community and has very well-attended and enthusiastic meetings.

Contractors' Dance.

The San Francisco Section of the California Association of Electrical Contractors and Dealers celebrated the association's fifth anniversary by a dinner dance at the Pompeian Court on August 20th. C. F. Butte, president of the Section, presided at the dinner, calling for brief remarks from C. V. Schneider, W. S. Hanbridge, L. R. Boynton, Frank Somers, W. D. Kohlwey, W. L. Goodwin, W. S. Berry, Jas. M. Barry, S. B. Gregory and M. L. Scobey.

The hall was beautifully decorated, an electric fountain spraying in the center. Tables were arranged at one end and the balance of the hall was arranged for dancing, which was enjoyed until midnight. A feature of the evening was the response of Mrs. W. S. Berry to the toast to the ladies.

The following were present:

C. V. Schneider and the Misses Schneider, Electric Supply Co., Stockton.
Mr. and Mrs. W. S. Hanbridge and Mrs. V. Wilkinson, Contractors' Association.
Mr. and Mrs. C. F. Butte, Butte Eng. & Elect. Co.
Mr. and Mrs. W. D. Kohlwey, Kohlwey Light Co.
Mr. and Mrs. L. R. Boynton, Central Electric Co.
Mr. and Mrs. J. M. Carlson, Central Electric Co.
Mr. and Mrs. Chamblin and Mr. J. D. McDonald, Cal. Elect. Construction Co.
Mr. and Mrs. N. Hope, Turner Co.
Mr. and Mrs. W. Kisten, Kisten Electric Co.
Mr. and Mrs. W. S. Berry, Western Electric Co.
Mr. and Mrs. Jas. M. Barry, Dept. of Electricity.
W. L. Goodwin, Mr. and Mrs. David Harris, Mr. and Mrs. M. L. Scobey, Miss Pantor, Pacific States Electric Co.
Mr. and Mrs. C. C. Hillis, Mr. and Mrs. Meinema, Electric Appliance Co.
Mr. and Mrs. Bert Hansen, A. G. Electric Co.
Mr. and Mrs. A. G. Drendell, Drendell Elec. & Mfg. Co.
Mr. and Mrs. S. B. Gregory, Arrow Electric Co.
Mr. and Mrs. A. G. Young, A. E. Rowe, Telephone & Electric Equipment Co.
Mr. and Mrs. H. Engel, Dunham, Carrigan & Hayden.
Mr. and Mrs. Jos. Thieben, Panama Lamp Co.
J. D. Flynn, Contractor, Insurance Dept.
Frank Somers, Century Electric Co.
Geo. Sittman, General El. Construction Co.
P. B. Hyde, Thos. A. Edison, Inc.
Messrs. Ross and Talent, General Electric Co.

Oregon Society Engineers.

The regular weekly luncheon of the Oregon Society of Engineers was held October 26th in the Crystal Dining Room of the Benson Hotel. The chairman of the day was F. D. Weber, electrical inspector of the Underwriters' Equitable Rating Bureau. The speaker of the day was Norman F. Titus, special agent Portland Steamship Company and the Dodge Steamship Company, also manager of the Commercial Dock & Warehouse Company. His subject was "The Portland-Alaska Steamship Line." Mr. Titus pointed out the volume of trade that could be procured in Alaska and stated that a large percentage could be obtained by establishing salesmen routes in Alaska. Up to the present time Seattle has had all the trade of Alaska due to the fact that she had no competition. The opening of the Panama Canal would also make it possible to ship the immense tonnage of fish produced in Alaska to European markets. This being a valuable return cargo from Alaska for the new line of boats. Also the marble, coal, gold and copper of Alaska must be shipped and Portland should get her share handling the same. He also pointed out that the passenger business was of large proportions and that since the first ship of the new line had been established they had turned hundreds away, not being able to accommodate them.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Los Angeles & San Diego Beach Company, operating between San Diego and La Jolla to issue a sufficient amount of bonds to yield $250,000 in cash. The proceeds derived from the sale of the bonds are to be used by the company for the electrization of its line, the improvement of its properties and the payment of certain obligations due E. S. Babcock.

The commission has authorized the Holton Power Company to issue $200,000 face value of its 6 per cent first and refunding mortgage gold bonds at not less than 80 and accrued interest. The proceeds from the sale of these bonds are to be used by the power company for various additions and betterments to its plant.

The Southern Sierras Power Company, operating in Inyo, Kern, San Bernardino and Riverside counties, has filed an application with the commission requesting authority to renew four promissory notes totaling $20,000 for a period of 4 months.

The commission has issued a supplemental order authorizing the Fresno Interurban Railway Company to issue $86,000 of its 1 year 6 per cent bonds at not less than 90, and 460 shares of its capital stock, having a par value of $100 per share, at not less than 80. The proceeds derived from the sale of these securities are to be used for the construction of an electric railway between Fresno and Clovis, a distance of approximately 9 miles.

The commission has rendered an opinion supplementing its recent decision in which the Western States Gas & Electric Company was authorized to issue $731,000 of 3 year 6 per cent promissory notes. The commission amends its previous decision to include the statement that in the opinion of the commission the purposes for which the notes are to be issued are not reasonably chargeable to operating expenses or to income.

The commission has issued an order extending to June 30, 1915, the effective date of its decision rendered April 2, 1913, in which the Pacific Electric Railway Company was authorized to issue $6,839,000 of refunding mortgage 50 year gold bonds.

The Southern Sierras Power Company, operating in the counties of Inyo, Kern, San Bernardino and Riverside, has filed an application with the commission requesting authority to issue $300,000 par value of its first mortgage 6 per cent 25 year gold bonds. The company proposes to sell these bonds at not less than 90 and to use the proceeds for the retirement of outstanding notes, discharge of various unpaid vouchers and partial payment of certain amounts due to the Sierras Construction Company for extensions and betterments to the power company's system.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The commission recently handed down an important decision in the case of the City of Seattle against the Seattle, Renton & Southern Railroad receivers. "A rule laid down by

the supreme court of the United States is the law of the land, and we therefore hold that the commission in appraising the right of way and terminals has the right to consider only the fair average market value of similar land in the vicinity. We therefore hold that the company has no right to include 'engineering,' 'legal expense,' 'interest during construction,' 'discount and commissions,' etc., based upon this hold-up value of the right of way of lands. If such methods of calculation are to be permitted in rate-making, the government cannot acquire these public utilities too soon. Under such a system this commission can never lower a rate once established.

"If an arbitrary multiple of 2 is permitted, by the same reason a multiple of 3 might be adopted. There is no logical reason, nor does justice demand that the patrons of a public utility pay interest on conjectural expenditures that were probably never made."

The Public Service Commission of Washington announces that valuation complaints will be filed in the immediate future against the Seattle, Renton & Southern Railway of Seattle for the purpose of establishing the actual value of that line for rate-making purposes.

TRADE NOTES.

Herbert C. Moss, illuminating engineer, Seattle, has been awarded the contract for the electrical equipment in the new Elks' Club building, Tacoma.

Hunt, Mirk & Co., representing the Westinghouse Machine Company, have moved their Seattle office from 909 Alaska building to 1407 Alaska building.

NePage-McKenna Company have received the electrical contract for the new Ballard High School to be erected in Seattle, Wash. The contract price was $8845.

David Dow & Son, Seattle, are furnishing a double drum electric hoist to Gilbertson & Tanberg, who have the contract for the brick and stone work on the new Stuart building.

The United States Steel Corporation has been awarded the contract for steel rails for use in the Tacoma tide flats municipal line. The contract calls for 152 gross tons of rails.

The Portland Oxygen & Hydrogen Company is erecting a plant to supply oxygen and hydrogen for welding and other industrial purposes at East Seventeenth and Center streets, Portland, Ore. E. A. Finkbeiner is manager of the company.

BOOKS RECEIVED.

"Coal Gas Residuals," by F. H. Wagner; 179 pp.; 6x9. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, Crossley Building, San Francisco. Price $2.00.

This work constitutes at once a valuable contribution to the literature on the conservation of natural resources and a practical suggestion to the gas man. It is concerned with the recovery of tar, naphthaline, cyanogen ammonia and other products manufactured from the residuals of coal gas manufacture. Particular attention has been given to the details of the Feld process. This book should prove invaluable to gas chemists and engineers.

"Principles and Practice of Electrical Engineering," by Alexander Gray, assistant professor of electrical engineering at McGill University; 391 pp.; 6x9. Published by McGraw Publishing Company, New York City, and for sale by Technical Book Shop, Crossley Building, San Francisco. Price $3.00.

This text is suited for individual study by those desiring to get a general idea of the principle of electrical engineering, being based on a lecture and laboratory course for students in civil, mechanical and mining engineering courses. The arrangements of the forty-three chapters follows a logical development from the simpler direct current to the more complex alternating current phenomena. The author has a clear, concise style and his explanations are more easily comprehended than in the average college text-book. A minimum of mathematical demonstration has been introduced and theoretical discussions are interspersed with descriptions of the instruments which are dependent upon each theory for their operation. The chapter on starting and controlling devices and on transformer connections are particularly good.

P. P. I. E. GAS EXHIBIT.

The following telegrams regarding a proposed exhibit of gas appliances at the Panama-Pacific International Exposition in conjunction with the meeting of the International Gas Congress during the week of September 27, 1915, are self-explanatory:

New York, October 23, 1914.

John A. Britton:

Committee on Gas Industry Exhibits P. P. I. E. active and many exhibits promised. Cowdery, chairman, wishes information. Can gas industry have collective exhibit? To whom ship goods, and how—who correspond with regarding shipments and care of them? What does P. P. I. E. do for exhibitions—what space is available—can we get twenty-five feet by three hundred feet? What will P. C. G. A. do in way of receiving and looking after exhibits before Exposition opens? Please wire me Hotel Astor.

E. C. JONES.

E. C. Jones:

P. P. I. E. can arrange to give space in manufacturers building eighty-five hundred square feet, being all of block one and part of blocks seventeen and eighteen. Plans can be seen at Acolian Building, Forty-second street, New York. Space contemplates doing away with Avenue A between Court of Honor Boulevard and Fifth street and moving aisle towards Avenue B so that space will be seventy feet on Fifth street and one hundred twenty feet on new avenue. No charge by Exposition Company for floor space. It requires, however, that organization exhibiting shall accumulate a fund equivalent to three dollars per square foot to be expended by organization in decoration features booth space, and pay for janitor service, etc. Plans of decorative features for space should be drawn up by architects and submitted for approval to Exhibit Committee Exposition Company in order that it may conform to requirements as to Underwriters' Rules, etc. If goods are shipped to Exposition Company prepaid, same will be returned to exhibitors without freight charge. Exposition Company requires that some one individual shall be in charge of all exhibits in order that direct responsibility may center and avoid confusion of a number of heads who might have to be conferred with by Exposition authorities. Above rate of three dollars per square foot is not to be handled in any way by Exposition Company, but as a guarantee fund that exhibit will be in keeping with other exhibits in the same building. This offer is made for prompt acceptance. Please wire.

JOHN A. BRITTON.

John A. Britton:

Wire received. Cannot give definite answer until next Saturday when Cowdery reaches Chicago. Committee says can raise quarter million dollars among manufacturers for exhibit. The ice has been broken and all gas appliance men express intention to exhibit. Have sent your wire to committee Chicago. I leave for home Wednesday. Please arouse interest in exhibit on Coast. E. C. JONES.

After Mr. Jones returns from the East a meeting will be held for the purpose of providing ways and means for aiding this movement.

NEW CATALOGUES.

Snow plow service, as is well known, is one of the hardest applications that has to be met by street railway equipments, and the Boston Elevated Company is taking particular pains to see that these cars and their equipment are such as will fully meet the service which they are designed to perform. The Boston Elevated Railway Company has placed an order with the Westinghouse Electric & Manufacturing Company for two quadruple equipments of No. 306 motors, and type HL unit switch control for use on two new snow plows which are being built by this company, and will be ready for the winter season.

NEWS NOTES

INCORPORATIONS.

ABERDEEN, WASH.—The Montesano Gas Company has been incorporated with a capitalization of $50,000, by F. R. Archer, E. E. Boner and Sidney Burnett.

WINNEMUCCA, NEV.—Articles of incorporation of the People's Gas Company have been filed with a capital stock of $100,000. The incorporators are J. R. McDonald, W. J. Compton, Frank L. Reber and W. J. Bell. The company is formed to install and operate a gas plant in Winnemucca.

FINANCIAL.

FOWLER, CAL.—A deed of trust has been filed with the county recorder for the transfer of the gas plant from the Fowler Gas Company to Adam D. Wilson. Mr. Wilson is one of the trustees, and the filing of the deed is the completion of the deal entered into some time ago between the city and A. A. Weber of Los Angeles, who promoted the gas plant in this city and carried it to a successful conclusion. The city will hereafter conduct the gas works and furnish gas to the city. The consideration is said to have been $15,000. The city takes over all holdings in all departments.

OAKLAND, CAL.—It is reported that a reorganization plan for the People's Water Company will be presented within a few days. It is said that the plan is being formulated by C. O. G. Miller, chairman of the committee, representing the holders of the People's Water bonds, who will submit it to the protective committees for the other classes of bonds. Of the several plans that have been under discussion and gossipped around the financial district is the following: The issuance of first mortgage sufficient to take up at par all the so-called underlying bonds and the notes of the People's Water Company secured by the People's Water bonds; the issuance of common stock sufficient to provide at par for People's Water bonds outstanding and sufficient to provide at 20 for the preferred stock the common stock to receive nothing.

ILLUMINATION.

AZUSA, CAL.—Bonds in the sum of $55,000 for light and water plants have been voted by residents of this city.

STOCKTON, CAL.—Electroliers will be installed shortly in Bours Park. The property owners of the district are to pay for the installation.

PORT ANGELES, WASH.—A contract for furnishing the county with $2000 worth of fixtures has been awarded to H. E. Gleason Company, Seattle.

SHOSHONE, IDAHO.—It is intended by the board of trustees to install the new nitrogen lights for street lighting, doing away with the present arc lights.

BELLINGHAM, WASH.—Fifty additional electric street lights will be placed in different parts of the city this month. These lights will all be of the incandescent type.

SPOKANE, WASH.—E. D. Couch, secretary of the Flathead Petroleum Company will superintend the installation of of an electric light system at this company's camp.

MONTESANO, WASH.—The county commissioners have granted a franchise to L. H. Burnett to lay gas mains along Olympic highway between Aberdeen and Elma, via Montesano.

FRESNO, CAL.—The council is now gathering information on different designs of electroliers. Bids for this work will be called for in a few days. The system will cost about $45,000.

SOUTH SAN FRANCISCO, CAL.—It is the intention of the board of public works to have the electrolier system of lighting along both sides of Grand avenue installed as soon as possible.

TACOMA, WASH.—A contract for furnishing the city with $10,000 worth of incandescent lamps has been awarded by Commissioner Drake to the Home Electric Company of Tacoma.

LOS ANGELES, CAL.—An ordinance for lighting Main street, between Pico and Thirty-sixth street, and portions of Washington and Jefferson streets has been adopted by the city council.

PORTLAND, ORE.—J. R. Wood, purchasing agent, has been authorized to call for bids for remodeling the lighting system in Peninsula park and the installation of a lighting system in Columbia Park.

ANACORTES, WASH.—The towns of Edison and Blanchard in Skagit County, Washington, are to be electrified. The poles are already in place and the houses are being wired and lights will be available early this month.

ALHAMBRA, CAL.—The lighting committee is considering a proposition made by the Little Rock Power & Water Company to furnish electric current to the city. The company has a power site 27 miles north of Alhambra.

PASADENA, CAL.—Work has been started on the ornamental lighting system for Madison street from Fillmore to Glenarm, residents having arranged with the municipal lighting system to install lamps and build conduits.

PORT TOWNSEND, WASH.—Improvements have just been completed on the Point Wilson lighthouse here, including a new tower and a new high-power lense. The old lighthouse on Point Wilson had been in operation since 1880.

LOS ANGELES, CAL.—The city council has denied all protests against installation of ornamental lighting system in Harvard boulevard between Sixteenth and Washington streets. The total cost of the system will aggregate $1642.40.

SEATTLE, WASH.—Superintendent Ross of the municipal lighting department reports that over 2,170 contracts were taken out for this service, over 1100 of these being for new business. According to Superintendent Ross this is due entirely to the steady, healthy growth of the city.

SEATTLE, WASH.—Mayor Gill promises to veto any appropriation made by the city council for the extension of the city lighting system outside the city limits. He takes the stand that, until every citizen who wants light is served, no attempt should be made to extend the system outside the city.

HUBBARD, ORE.—It is expected that within a few months the Portland Railway, Light & Power Company, from their base at Salem, will install a competitive system of electric lights in Hubbard. The present current is furnished by the Molalla Electric Light Company, of Canby. It is said that their service is poor and that the rates are exorbitant. The Railway Commission will hold a session next week in Hubbard to investigate the claims of losses sustained by the creamery and several mills through lack of electric power.

TRANSMISSION.

FALL RIVER MILLS, CAL.—Equipment is arriving for the new power plant to be installed by the California Power & Manufacturing Company, which purchased the electric light plant and water rights from Florin Bros. last spring, and also purchased the Florin flour mill.

SAN DIEGO, CAL.—The county board of supervisors has under consideration an application of the Escondido Mutual Water Company for a franchise to build an electric trans-

mission line from the power plant on San Luis Rey River to the power plant below the reservoir and then to Escondido.

LOS ANGELES, CAL.—The Union Hollywood Water Company has made another proposition to the city water board for the purchase of its system by the city. The company offers to sell its entire plant and system within the city for $750,000, on a monthly payment basis. The city offered to purchase such portions of this system as it desires, but its offer was rejected.

OCEANSIDE, CAL.—The South Coast Land Company has opened negotiations with the Oceanside Electric Company for the extension of light and power wires to South Oceanside and Carlsbad, to which sections the land company is carrying water for irrigating and domestic purposes from the San Luis Rey River. Water is to be pumped from the San Luis Rey River bottom and lifted to reservoirs on the south bank of the river and then distributed to the extensive lands of the company south of Oceanside.

TRANSPORTATION.

SAN FRANCISCO, CAL.—A contract has been awarded for furnishing a quantity of track specials for the municipal railways system, to the United States Steel Products Company for $6161.

SPOKANE, WASH.—Building committee of Whitworth College favor construction of car line with steel rails and gasoline cars to serve the college.

EASTON, CAL.—Surveyors are at work laying out the route of extensions of the Easton electric railroad, which is to run along the present route of storage battery road from the station to Burlingame Hills.

OAKLAND, CAL.—On November 1st a new schedule went into effect calling for five trains every hour from the Fourteenth and Franklin station of the Southern Pacific in Oakland. Two of these trains come to San Francisco by way of Alameda mole, leaving the station at 5 minutes and 35 minutes after the hour. Three trains come through Oakland along Eighteenth street and to the Oakland mole. The necessity of transferring at the Sixteenth street station is eliminated. These three trains will leave Fourteenth and Franklin 15, 35 and 55 minutes after the hours.

BERKELEY, CAL.—In compliance with the agreement reached between the city and the Key Route officials regarding the paving of Grove street, the city council has passed a modified paving ordinance requiring the company to lay concrete girders under the tracks on that street in place of a solid concrete mattress ordered in the ordinance which the council refuses to pass. The hearing in the matter of the injunction restraining the city from stopping the Key Route trains will be held in the U. S. District Court on December 14th, according to the agreement entered into by counsel for both sides. The temporary orders remains in force.

SEASIDE, ORE.—Preliminary steps have been taken toward the establishment of an electric interurban line from this city to Astoria as to the first link in a comprehensive Coast system of electric lines. The city council was asked to extend the time limit on a franchise through this city that is held now by O. W. Taylor. Prior to the presenting of the request to the council, considerable work had been done by interested residents of Seaside and Astoria in securing data and it is believed that practically all the necessary right of way can be had gratis and that at least part of the cost of the line can be secured in the immediate vicinity.

FRESNO, CAL.—Work on the construction of the Fresno Interurban line to extend from Fresno avenue by way of the Normal School to Gould Colony will be commenced within the next few days. This line will be about two miles long. Construction work on a ¼ mile extension to the present Clovis line will be begun during the next two days. It has been rumored that a 12 mile branch line of the Interurban from Barton's vineyard to Centerville will be constructed on the main line to Clovis. J. H. Crossett, who has been general manager of the Interurban, has resigned and will become consulting engineer for a road in the South. John McCaffery, who has been connected with the firm of Mahoney Bros., will succeed Crossett as manager.

PORTLAND, ORE.—In consequence of the order issued by the county commissioners requiring the United Railways Company to remove its tracks and vacate the right of way over the Linnton road on February 1st, it is regarded as probable that the company will abandon its service over that route to Linnton at least. It has been suggested that gas-electric equipment might be used over the tracks of the Spokane, Portland & Seattle Railroad to Linnton and its present electric equipment operated from Linnton to the terminus at Wilkesboro. Such a plan would involve the construction of only a small strip of track near Linnton. Just what steps will be taken to meet the present situation will be announced probably within the next few days.

TELEPHONE AND TELEGRAPH.

HANFORD, CAL.—Farmers of Burrel are planning to connect with Riverdale and the trunk telephone line by means of a farmers' line.

PORTLAND, ORE.—F. H. Crosby of San Francisco has purchased the stocks and bonds of the Northwestern Long Distance Telephone Company, representing the holdings of the Pacific Telephone & Telegraph Company, for $360,000. The sale was officially approved by Judge Bean in the Federal Court. This marks the end of the government's anti-trust suit, waged for several months against the Bell companies in the Pacific Northwest, and fulfills a decree entered by Judge Bean, March 26 last, dissolving the merger and ordering the Bell companies to sell their holdings at Spokane and their Northwestern long distance properties in Oregon and Washington. The properties included lines on the east and west sides of the Willamette Valley, extending from Corvallis on the south through Portland and Southwestern Washington to Tacoma and Seattle on the north.

WATERWORKS.

CLYDE PARK, MONT.—The special election held here to vote on the issuance of $19,000 bonds for the installation of a waterworks system resulted in favor of the proposition.

AMITY, ORE.—G. T. Morgan, a contractor from Portland, was in Amity recently interviewing the city council relative to waterworks. Mr. Morgan has just completed the waterworks system at Lafayette.

LOS ANGELES, CAL.—The report of the superintendent of county machinery on specifications for improvement work in the Westlake lighting district has been referred to the lighting committee of the district.

BOISE, IDAHO.—The Boise Artesian Hot and Cold Water Company will extend its waterworks system to cover the south side section. It proposes to build a line across Broadway bridge and lay mains to serve all settled parts across the river. The proposed work will cost about $20,000.

HOOD RIVER, ORE.—Judge W. L. Bradshaw overruled the petition filed by the Oregon Lumber Company asking for a writ of injunction restraining the East Fork Irrigation District from appropriating additional water from Hood River claimed by the Oregon Company. The ditch company will begin at once to enlarge the ditch.

CALEXICO, CAL.—Three bids for the construction of the proposed sand filter and washer for the local water system were received by the city council. Bids were received from P. L. Hedrick of El Centro, Rice & Dutcher of Imperial, and Blaisdell Filtration Company of Los Angeles. The prices were $4969, $5312 and $5000. The bids were laid over for further consideration.